MASTER PLAN UPDATE

JULY 2019

Mead & Hunt

Bismarck AIRPORT

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Mead & Hunt

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Bismarck AIRPORT

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1.0 INVENTORY OF EXISTING CONDITIONS

One of the initial tasks in the preparation of an airport master plan is the collection of information on the condition of existing facilities and services. This inventory of data is necessary to not only evaluate the physical attributes of the airside, landside, and support facility infrastructure, but also to complete subsequent study tasks such as demand/capacity analyses and the determination of facility requirements. The information collected focuses on the use, size, quantity, type, area, operational intent, and other characteristics of the airside and landside components of the Bismarck Airport. Typical categories of information that are collected include history, physical infrastructure, regional setting, surrounding land uses, environmental features, historical aviation activity, business affairs, and socioeconomic demographics of the surrounding community.

Several sources of information were reviewed to compile a comprehensive database of the facilities and services at the Bismarck Airport (Airport). These included, but were not limited to, the previous Airport Master Plan, the 2014 North Dakota State Aviation System Plan, 2015 North Dakota Airport Economic Impact Study, Bismarck Airport Pavement Condition Index Report, recent National Environmental Policy Act (NEPA) documents, the Bismarck Airport website, land use documents, and the current Airport Layout Plan (ALP). In addition, historical enplanements, aircraft operations, based aircraft, aircraft fleet mix, enplaned cargo, and automobile parking data were obtained from Federal Aviation Administration (FAA) databases and Airport records. Finally, an on-site visual inspection of the Airport was conducted in November 2015 to complete the inventory effort and verify any data discrepancies.

Organized by the following sections, this Chapter summarizes the data that was collected on the condition of existing Airport facilities and services:

1.1 Airport Location and Role
1.2 Airport History
1.3 Surrounding Environment and Land Use
1.4 Socioeconomic Data
1.5 Organizational Structure
1.6 Existing Facilities
1.7 Businesses and Tenants
1.8 Airspace, Air Traffic Control and Approach Procedures
1.9 Summary

1.1. AIRPORT LOCATION AND ROLE

As shown in **Exhibit 1-1**, Bismarck is located in the southern half of central North Dakota, approximately 190 miles west of Fargo, North Dakota and 175 miles east of the Montana-North Dakota border. The Airport is located in Burleigh County on the southeast side of the City of Bismarck. Interstate 94 passes through Bismarck linking it to Fargo and Interstate 29 (I-29) to the east and Billings (415 miles) and Interstate 90 to the west. Other major highway access to Bismarck is provided by Highway 83 which links to Minot (110 miles) and Highway 2 to the north. In addition to being known as the location of the state capitol, the City of Bismarck is also known for its prominent place on the banks of the Missouri River. Bismarck, and its sister city, Mandan, have evolved over time to serve the needs of the large government workforce, tourism industry and energy industry, as well as those drawn to the area's natural beauty and outdoor opportunities. Many institutions of higher learning are located in the area to support the needs of this growing community, including University of Mary, United Tribes Technical College, and Bismarck State College. The private sector has also seen significant growth with Sanford Health, Basin Electric, CHI St. Alexius Medical Center, Montana-Dakota Utilities (MDU) Company, Walmart, and Aetna becoming some of the largest employers in the region.

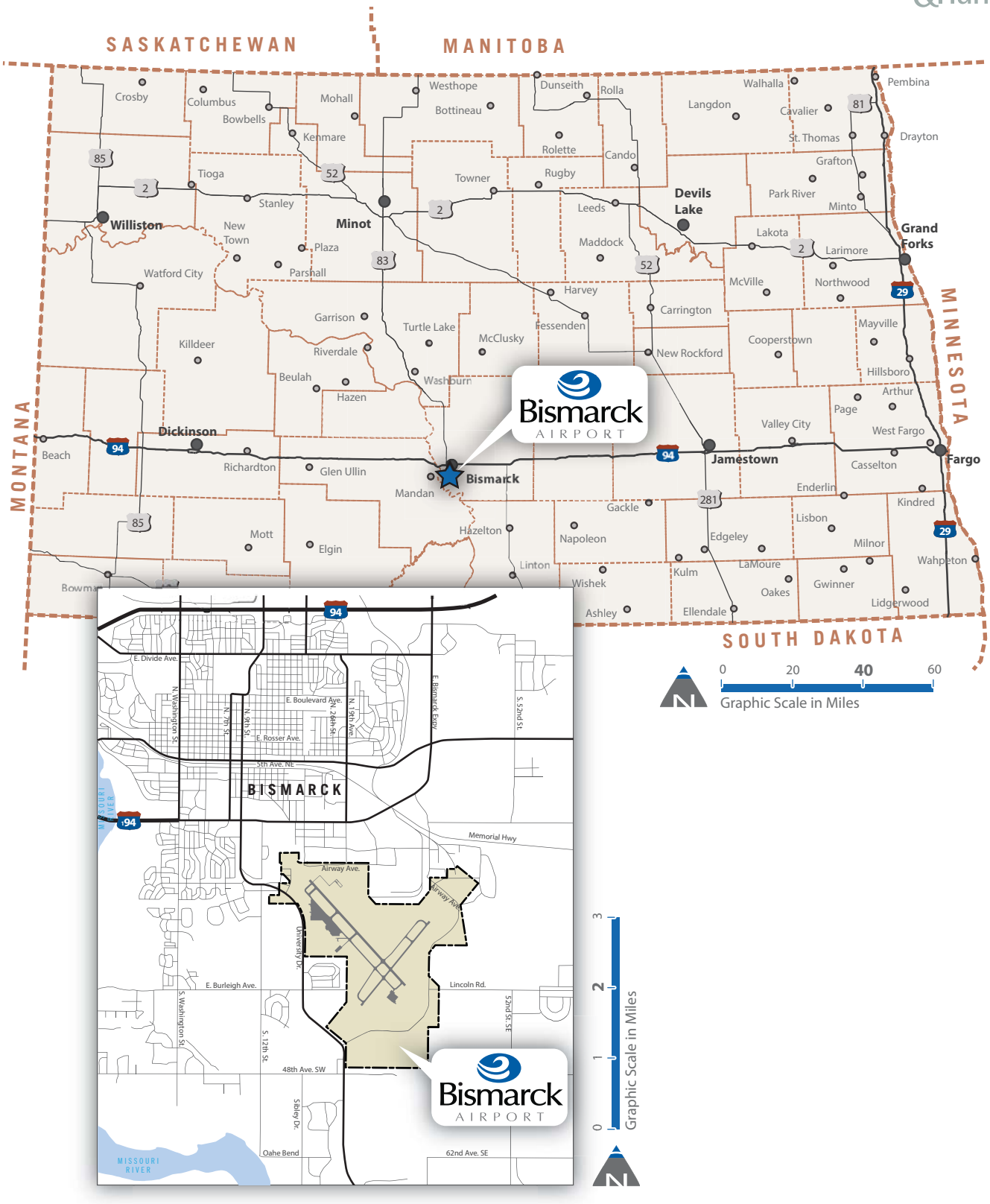

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Exhibit 1-1 **Bismarck Airport Location Map**

1.1.1. Federal and State Role

The identification of an airport's role and classification is one of the FAA's primary responsibilities. The Airport is a vital air transportation center for the capitol city of North Dakota, and the state as a whole. Along with approximately 250 other airports nationwide, it is classified in the federal National Plan of Integrated Airport Systems (NPIAS) as a primary, non-hub commercial service airport which is required to support the demands of the nation's aviation system. A primary, non-hub airport is defined by the FAA as having more than 10,000 passenger boardings (enplanements) that make up less than 0.05% nationwide boardings. In order to receive federal funding, an airport must be included in the NPIAS. The FAA prepares a NPIAS report for Congress every two years. This report identifies those airports considered to be vital to the nation's airspace system and classifies airports according to their relationship within the broader transportation network. In 2014, the North Dakota Aeronautics Commission (NDAC) revised their proprietary airport classification system to align with criteria published by the FAA. As depicted in **Exhibit 1-2**, the Bismarck Airport is one of eight commercial service airports within the State of North Dakota.

1.1.2. Surrounding Airports

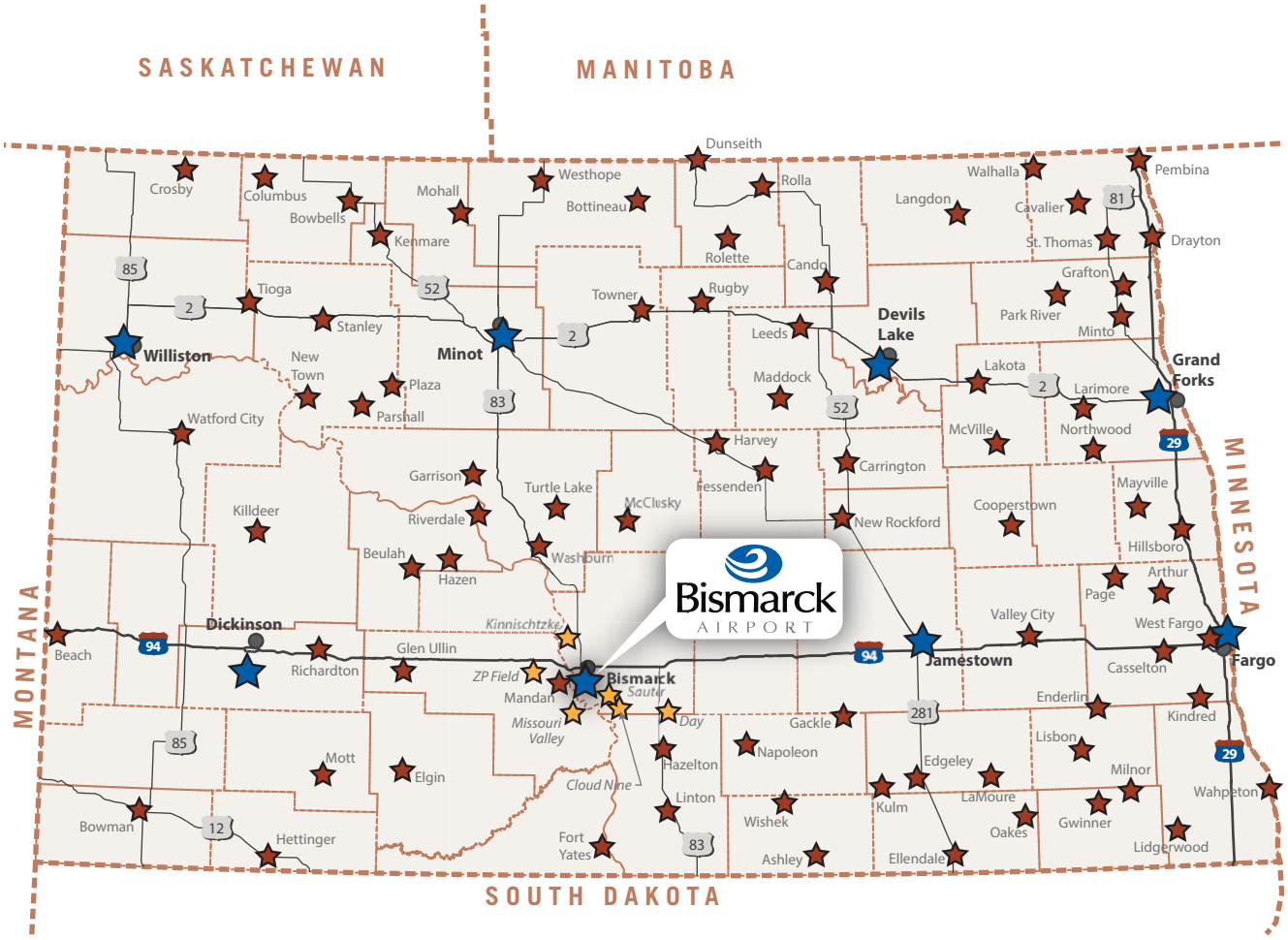
The identification of surrounding airports is important when evaluating an airport's service area as well as the potential impact other airports may have on surrounding airspace. Within 35 miles of the Bismarck Airport, there are only two publicly owned, public-use general aviation airports. These include:

- Mandan Municipal, near Mandan (located approximately 13 miles (nm) to the west, 30 miles by car)
- Hazelton Municipal, near Hazelton (located approximately 30 nm to the southeast, 45 miles by car)

In addition, there are six privately-owned airports in proximity to the Bismarck Airport:

- Sauter Airstrip, near Bismarck (located approximately 3 nm to the northeast)
- Cloud Nine, near Lincoln (located 4 nm to the east)
- Kalberer, near Lincoln (located 7 nm to the southeast)
- Kinnischtzke Airfield, near Harmon (located approximately 12 nm to the north)
- Day Private Airfield, near Moffit (located approximately 16 nm to the southeast)
- Z.P. Field, near Mandan (located approximately 17 nm to the northwest)

Classified as general aviation airports, these eight airports have a limited impact on the overall operation of the Bismarck Airport. Primarily, these eight facilities focus on smaller general aviation operations and cater to aerial applicators, recreational and sport pilots who do not routinely require the extensive amenities offered at the larger airport, such as Bismarck. Airports like these provide an important option for aircraft owners and pilots who utilize aircraft for purposes of recreation rather than for business purposes. Exhibit 1-2 illustrates the locations of the commercial, general aviation, and privately-owned airports relative to the Bismarck Airport.



SOURCE: *2014 North Dakota State System Plan.*

Exhibit 1-2 **North Dakota Airports**

1.1.3. Commercial Airline Service

Commercial airline service at the Airport is provided by Allegiant Air, American Airlines, Delta Air Lines, Frontier Airlines (seasonal), and United Airlines. As of January 2016, these airlines offer round trip flights to and from Chicago (ORD), Dallas/Fort Worth (DFW), Orlando/Sanford (SFB), Denver (DEN), Las Vegas (LAS), Minneapolis/St. Paul (MSP), and Phoenix/Mesa (IWA). Other airports offering commercial airline service in close proximity to the Bismarck region include:

- Dickinson Theodore Roosevelt Regional Airport, near Dickinson (103-mile driving distance to the west)
- Jamestown Regional Airport, in Jamestown (104-mile driving distance to the east)
- Minot International Airport, in Minot (112-mile driving distance to the north)

Two of these nearby airports, Dickinson Theodore Roosevelt Regional Airport and Jamestown Regional Airport, are eligible to participate in the Essential Air Service (EAS) program and receive federal funds from the United States Department of Transportation (USDOT). This money is used to support commercial airline operations within these small communities. Prior to airline deregulation, many of these same airports were served by certified air carriers. Currently, EAS at Dickinson and Jamestown is maintained at a minimal level. EAS subsidies are generally awarded as two-year contracts with renewal dependent upon several factors such as the average number of passengers enplaned daily at an airport. This is important to note since commercial airline service at these airports could be discontinued if EAS subsidies are not renewed in these communities. It is worth noting, however, that, due to favorable economic conditions, the Airport in Dickinson has seen an increase in alternative sources of funding and is not currently accepting these subsidies.

1.2. AIRPORT HISTORY

Pre 1920-1950

As the dawn of powered flight began to shape the use of aircraft throughout the US, the state of North Dakota began writing its own aviation history. The State's aviation history began primarily as a result of World War I which saw the use of aircraft during the years of 1914 through 1918. In July 1916, the City of Bismarck experienced its first-ever aircraft landing. As excitement continued to build for aviation in the State, the City built its first airport located on South Washington Street. Known as Straus Field, Bismarck's first airport consisted of approximately 80 acres which was leased from local resident F.B. Straus and Cora S. McLean. Straus Field grew to approximately 300 acres through purchases from other landowners and the War Assets Administration.

Stinson Detroiter, 1930s Source: Charles Rector (2015)

Several years later, the City relocated the Airport from Washington Street to its present location on University Drive (Highway 1804). The decision to move the Airport stemmed from the passage of the Air Commerce Act of 1926 which empowered the US Government to modernize air travel. A number of important conditions in this act included: a requirement that the government establish a system for air commerce; issue regulations for air traffic rules; procedure requirements for pilot licensing; develop a procedure for certifying the airworthiness of aircraft; and standardize airways to bring order to the open skies. Shortly after Charles Lindberg's 1927 transcontinental flight, North Dakota's own Carl Ben Eielson demonstrated how to fly over the top of the world when he departed Point Barrow, Alaska for Spitzbergen- an island located off the coast of Norway.

Aviation within the state began to connect the City of Bismarck with the rest of the country in the summer of 1931. In the same year, Northwest Airlines landed a Stinson Detroiter at the Bismarck Airport. This was the first commercial passenger aircraft to arrive in the city. In 1936, the Airport constructed its first modern-designed hangar which consisted of an art deco style building still present at the Airport today. For many years this hangar was the epicenter of activity at the Bismarck Airport. By 1939, additional airlines began operating from the Airport. Hanford Airlines and Mid-Continent Airlines provided commercial service flights between Bismarck and Tulsa, Oklahoma. Other airlines including Braniff, North Central, and Frontier began operating from Bismarck; however, the coming years would see many mergers and acquisitions which resulted in fewer airlines serving the Airport. Still, Northwest Airlines dominated commercial activity at Bismarck Airport during the Airport's first six decades.

In 1940, the City of Bismarck became the official owners of the Airport. In that same year, the City purchased an additional 60 acres of property from the Watcher family and the Works Progress Administration (WPA) helped to construct the first paved runways at the Airport. The development of these runways would prove useful during World War II as the 7th Ferry Command of the Army Air Corps relied heavily on the Bismarck Airport as a location to provide flight training for its pilots. Two years later under the Federal Airports Act of 1946, the War Assets Administration transferred 160 acres to the city for future airport development. In 1946, Fort Lincoln gifted a parcel of land which would later be used to develop a new terminal building at the Airport.

The 1950s and 1960s

The 1950s saw many improvements to the Airport. In 1950 and continuing through 1951, the Airport made significant improvements to its drainage conditions. Also, in 1950, a total of $31,000 was spent on enhancing Bismarck's Air Traffic Control Tower (ATCT) through a joint funding effort between the City and the US Government. These tower

improvements allowed for flight control and communications systems to be consolidated into one operation, reducing the number of employees from eleven to six. In 1952, a two-phased north-south (Runway 13-31) runway reconstruction project was initiated in order to support larger and heavier aircraft such as the Douglass DC-3 and Convair.

Five years later, in 1957, the second phase of the Runway 13-31 reconstruction project was completed. In 1962, Runway 13-31 was extended to 6,925 feet to accommodate jet aircraft. The years 1964 and 1965 included a major extension of the City's sanitary sewer system and water main connection for the development of a new terminal building. The new terminal's construction was completed the following year. Other projects occurring during the late 1960's included the construction of a crosswind runway (Runway 17-35), new taxiways, aircraft aprons, airfield lighting, vehicular parking lots, terminal access roadway, and additional drainage modifications to channel surface water on the airfield. The number of passengers using the Airport increased significantly from 1960 to 1965. For example, in 1960, the Bismarck Airport serviced 35,280 passengers. Within five years, the number of passengers grew to nearly 67,000. As reported during the 1970 US Census, this level of growth was consistent with the increase in population experienced in both Burleigh and Morton Counties. By 1972, the number of passengers using the Bismarck Airport swelled to 133,000.

The 1970s and 1980s

As the number of passengers increased, so did the size of the aircraft operating at the Airport. This was primarily due to the development of larger jet aircraft such as the Boeing 727 and DC-9. To accommodate the demand, the Airport began a series of airport improvements to the north-south runway and the terminal building. Runway 13-31 was extended a second time from 6,925 feet to its existing length of 8,794 feet. Improvements to the terminal building included the development of a baggage belt and baggage claim area, as well as passenger boarding bridges, used to load passengers onto commercial

aircraft. In 1976, a new ATCT was constructed on the south side of the airport. This ATCT is still used today by the FAA. Additional construction in the early 1980s resulted in a substantial extension to the south end of the terminal building and included a second level with connecting passenger boarding bridges.

1990 – Present Day

In 1990 Bismarck had three network carriers; Northwest, Continental, and Delta which provided service to three hubs in Minneapolis, Denver, and Salt Lake City. As the decade progressed, several changes took place with carrier mergers and acquisitions as well as an increase in operations by the regional carriers. Bismarck saw the departure of Delta and Continental, the entrance of United, and the return in 1994 of Frontier, and then Frontier's departure in 1996. The one steady force was Northwest Airlines who carried the bulk of the passengers during this time. Then in 2004, newcomer Allegiant Air entered the market; providing low-cost, less-than-daily service to Las Vegas (LAS). The entry of Allegiant marked a turning point in passenger activity at Bismarck. Starting with just two flights per week to Las Vegas in 2004, Allegiant carried 15,000 passengers in their first year of service. With access to the legacy carrier networks of Northwest and United, and the low-cost option provided by Allegiant, passenger numbers continued to grow over the next two decades.

To accommodate demand, the Airport set out to construct a new terminal to meet these needs. In May 2005, Bismarck completed the development of a state-of-the-art terminal with a clean contemporary look and feel. This one of a kind terminal was designed to

complement the natural surroundings of the region and is considered an iconic building within the City.

Over the last decade the Airport has continued to experience growth in its passengers an air carrier service, even amid more acquisitions and mergers in the airline industry. In 2008, Delta Airlines acquired Northwest Airlines, and in 2010 United merged with Continental. Both airlines continue to provide service from Bismarck, with United's service to Denver and Delta's service to Minneapolis. Allegiant has grown their operations to three destinations; Las Vegas, NV, Mesa, AZ, and Sanford/Orlando, FL, with over 60,000 passenger enplanements per year. Frontier Airlines returned to the Bismarck market for a third time in 2012 with a new low fare business model from Denver. In 2014, American joined the successful airlines with service to Bismarck with service to two of their largest hubs; Dallas – Fort Worth and Chicago - O'Hare. With the addition of American Airlines, Bismarck Airport has five airlines providing non-stop service to seven destinations. These air carrier additions made it easier to meet the increasing demand for air travel that resulted from the upswing in activity in the oil and gas industry in western North Dakota. All of these changes have resulted in the Airport setting new boarding records year after year for the last decade. As of 2016, the Airport now encompasses over 2,400 acres of property and has started the process of identifying its facility needs for the next 20 years, through 2035. **Exhibit 1-3** provides a historical timeline of the Bismarck Airport's history.

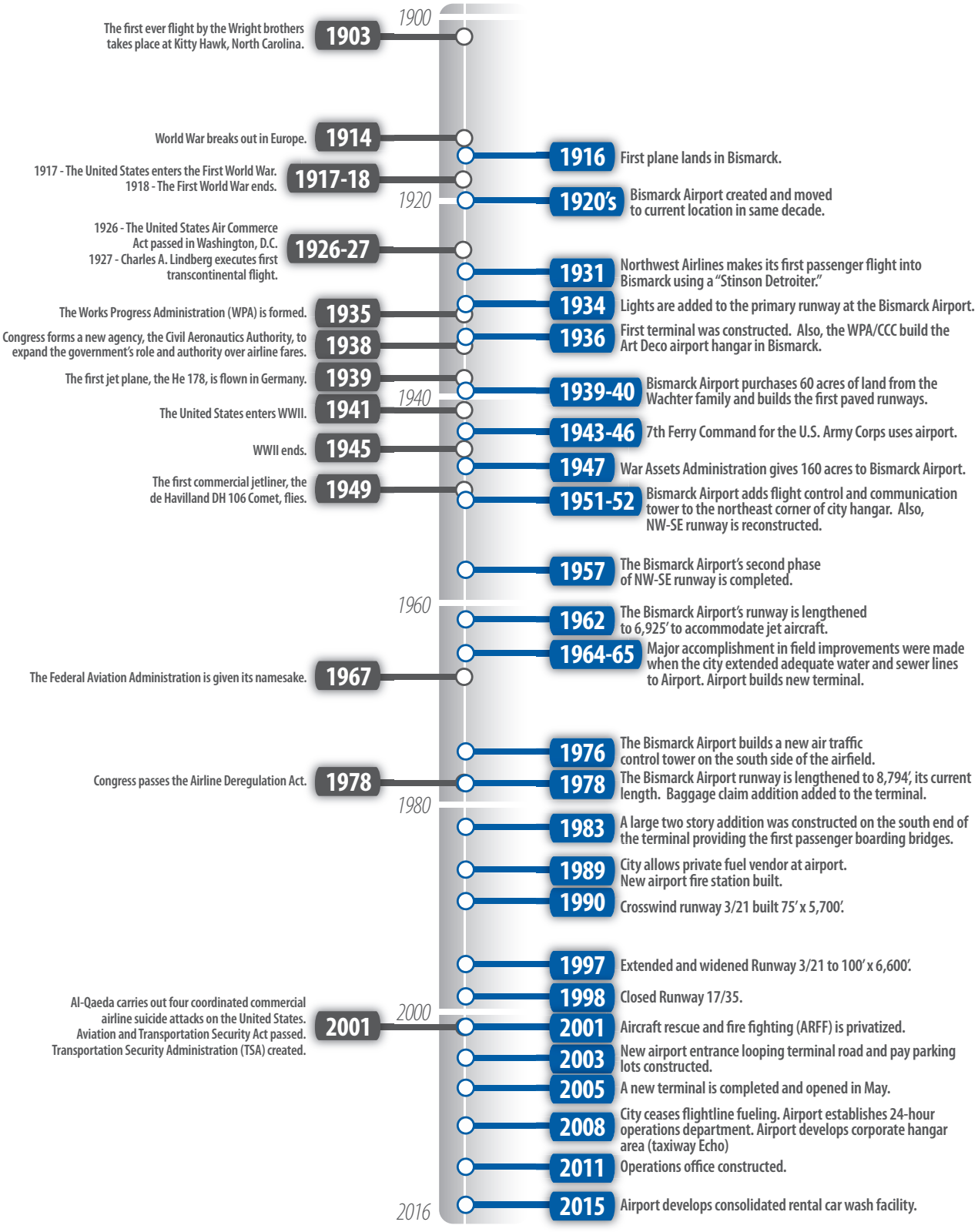

1900
1903
The first ever flight by the Wright brothers takes place at Kitty Hawk, North Carolina.
1914
World War breaks out in Europe.
1916
First plane lands in Bismarck.
1917-18
1917 - The United States enters the First World War.
1918 - The First World War ends.
1920
1920's
Bismarck Airport created and moved to current location in same decade.
1926-27
1926 - The United States Air Commerce Act passed in Washington, D.C.
1927 - Charles A. Lindberg executes first transcontinental flight.
1931
Northwest Airlines makes its first passenger flight into Bismarck using a "Stinson Detroiter."
1935
The Works Progress Administration (WPA) is formed.
1934
Lights are added to the primary runway at the Bismarck Airport.
1938
Congress forms a new agency, the Civil Aeronautics Authority, to expand the government's role and authority over airline fares.
1936
First terminal was constructed. Also, the WPA/CCC build the Art Deco airport hangar in Bismarck.
1939
The first jet plane, the He 178, is flown in Germany.
1939-40
Bismarck Airport purchases 60 acres of land from the Wachter family and builds the first paved runways.
1940
1941
The United States enters WWII.
1943-46
7th Ferry Command for the U.S. Army Corps uses airport.
1945
WWII ends.
1947
War Assets Administration gives 160 acres to Bismarck Airport.
1949
The first commercial jetliner, the de Havilland DH 106 Comet, flies.
1951-52
Bismarck Airport adds flight control and communication tower to the northeast corner of city hangar. Also, NW-SE runway is reconstructed.
1957
The Bismarck Airport's second phase of NW-SE runway is completed.
1960
1962
The Bismarck Airport's runway is lengthened to 6,925' to accommodate jet aircraft.
1964-65
Major accomplishment in field improvements were made when the city extended adequate water and sewer lines to Airport. Airport builds new terminal.
1967
The Federal Aviation Administration is given its namesake.
1976
The Bismarck Airport builds a new air traffic control tower on the south side of the airfield.
1978
Congress passes the Airline Deregulation Act.
1978
The Bismarck Airport runway is lengthened to 8,794', its current length. Baggage claim addition added to the terminal.
1980
1983
A large two story addition was constructed on the south end of the terminal providing the first passenger boarding bridges.
1989
City allows private fuel vendor at airport. New airport fire station built.
1990
Crosswind runway 3/21 built 75' x 5,700'.
1997
Extended and widened Runway 3/21 to 100' x 6,600'.
1998
Closed Runway 17/35.
2000
Al-Qaeda carries out four coordinated commercial airline suicide attacks on the United States. Aviation and Transportation Security Act passed. Transportation Security Administration (TSA) created.
2001
2001
Aircraft rescue and fire fighting (ARFF) is privatized.
2003
New airport entrance looping terminal road and pay parking lots constructed.
2005
A new terminal is completed and opened in May.
2008
City ceases flightline fueling. Airport establishes 24-hour operations department. Airport develops corporate hangar area (taxiway Echo)
2011
Operations office constructed.
2016
2015
Airport develops consolidated rental car wash facility.

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Exhibit 1-3 **Bismarck Airport Historical Timeline**

1.3. SURROUNDING ENVIRONMENT AND LAND USE

In order to plan for future airport development, local environmental conditions and surrounding land uses must be well understood. Topography, soil type, and climate can all factor into determining future infrastructure needs and areas suitable for development while surrounding land uses can influence growth and expansion opportunities. As part of the inventory data collection effort, information was gathered on local environmental conditions and a review was conducted of surrounding land uses. This section summarizes the Airport's environs and adjacent land uses.

1.3.1. Topography

The Bismarck Airport is positioned within a 30- to 70-mile-wide strip of land called the Missouri Coteau. This ribbon of land runs from the northwest corner of the state to the south center. It was the location of the furthermost advance of glacial ice into the region. This advance and retreat of glacial ice cut sharply undulating topography with 300 to 500 feet of relief that is now primarily used as rangeland. Bismarck is also located in the Missouri River watershed, along the Missouri River, located approximately three miles west of the Airport. The Airport is located at elevation of 1,661 feet above mean sea level (MSL) and covers more than 2,400 acres of land bordered by an assortment of farm and ranch land and mixed-use areas.

1.3.2. Soil Composition

The United States Department of Agriculture (USDA) Web Soil Survey lists a majority of the soils on and around the Airport as loamy sand and silt varieties. This type of soil is a medium, well-drained soil that is not predominantly sand, silt, or clay. It contains a large amount of humus and is very suitable to farming and agricultural applications. This soil readily absorbs water, and then drains easily when inundated. The soil has high moisture retention and is considered prime farmland. Loam soils are easily tillable and makes for attractive crop lands when topography allows. Multiple areas of the airfield are leased to

local farmers for low-profile crop production to increase Airport revenue. Other soil types surrounding the immediate proximity of Airport property include Parshall-Lihan fine sandy loams, Mandan silt loams, and Havrelon silty clay. All of these categories are able to support construction and agriculture uses on the airfield.

1.3.3. Meteorological Conditions

Bismarck has a humid continental climate that is characterized by seasonal temperature differences and year-round precipitation. Winters are typically cold, with average temperatures in January reaching as low as 2 degrees Fahrenheit, and highs around 23 degrees Fahrenheit. Summers offer fairer temperatures with the average temperatures in July reaching a high of 85 degrees Fahrenheit and a low of 57 degrees Fahrenheit. Winds from the north and west are responsible for most of the weather patterns that affect the state, although summer storms from the southwest regularly affect weather patterns. On average, the area receives 17.82 inches of annual precipitation, with 3.19 inches on average in the wettest month of June. In a typical year, approximately 50 inches of snow fall on the area, with diminutive totals of accumulation between winter months.

1.3.4. Generalized Land Use

When studying and creating a plan for future development, the use of land that borders an airport should be reviewed to identify any possible issues if an expansion of facilities outside an airport's existing property line is needed. To the north of the airport, a majority of the property is mixed commercial and industrial land uses, with residential land use increasing when moving to the west. The west side of the Airport is bordered by park and agricultural land, as well as ND Soil Conservation Forestry Property, with considerable residential land use extending from the north to the south. United Tribes Technical College is also located on this side of the airfield, just to the south of the airline terminal. The south side of the Airport consists primarily of farm and ranch land with pockets of residential developments towards the Missouri River. The east side of the Airport consists

of nearly all uninhabited land until reaching the town of Lincoln, approximately two miles from the Airport fence. **Exhibit 1-4** defines these areas in relation to Airport property.

1.4. AREA DEMOGRAPHICS

Demographic data is used to assess the economic climate in an area by identifying and comparing statistics and trends in population, sales, employment, and other relevant factors that help gauge the health of an economy. The strength of these factors may be directly supported by airport activity and can promote a substantial impact to a region.

1.4.1. Socioeconomic Data

The socioeconomic conditions within an Airport's primary service area must be acknowledged before future aviation activity projections can be developed to determine what development needs will be required over the next 20 years. Though a majority of the regular users reside in and around the City of Bismarck, the Airport's service area includes at least five Central North Dakota counties as illustrated in **Exhibit 1-5**. Socioeconomic data obtained by Woods & Poole Economics indicate the total population of the five counties that comprise the Airport's service area in 2015 was 125,622. Populations of the individual counties within the service area are summarized in **Table 1-1**, which indicates that overall population grew by 16.12 percent, from 108,179 in 2005 to 125,622 by 2015.

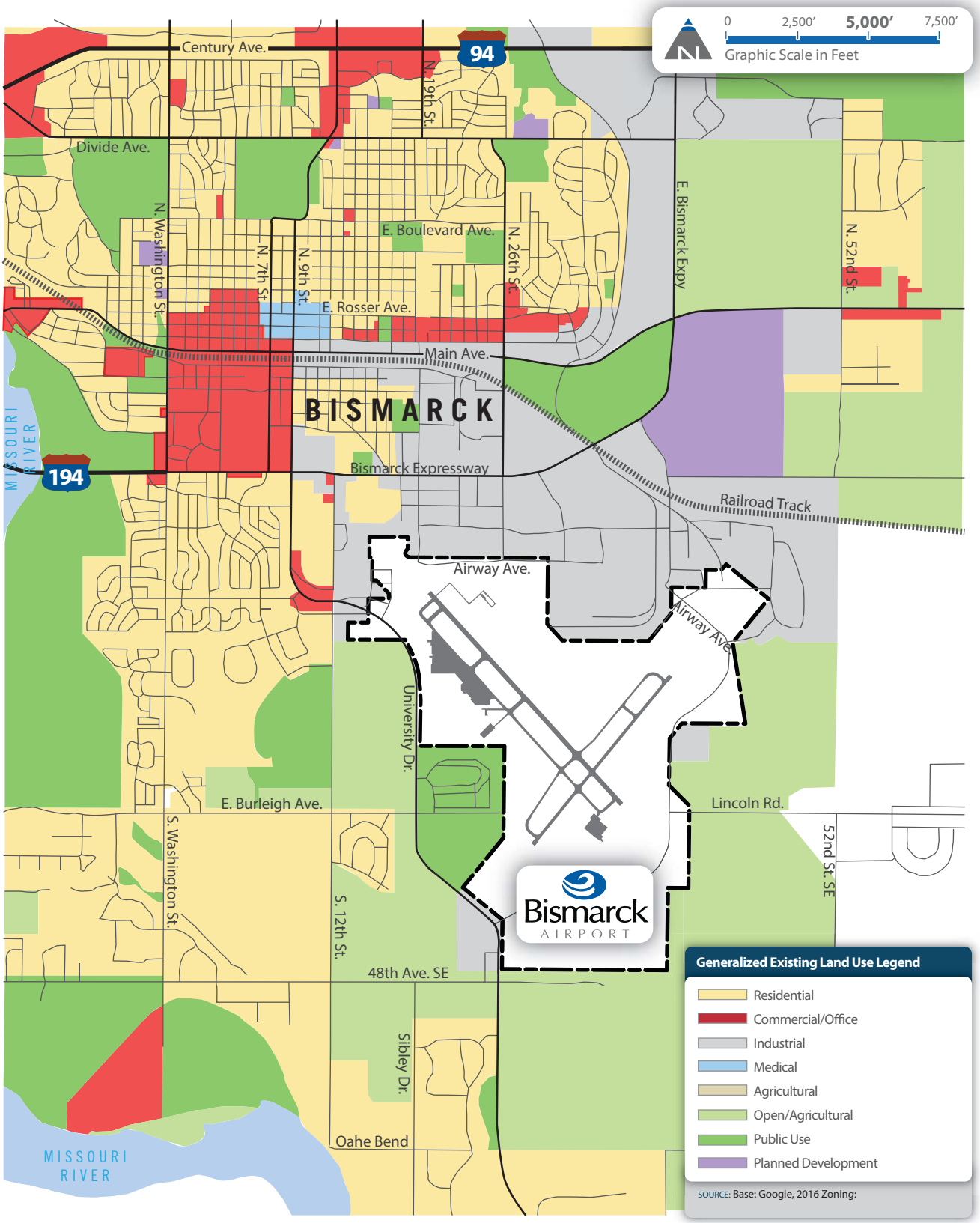


Exhibit 1-4 **Surrounding Land Use Map**

Table 1-1 Socioeconomic Statistics									
	Population			Retail Sales			Employment		
County	2005	2015	% Change	2005	2015	% Change	2005	2015	% Change
Burleigh	74,375	89,306	20.08%	1,443,733,000	1,708,409,000	18.33%	61,929	76,450	23.45%
Emmons	3,825	3,502	-8.44%	34,957,000	26,985,000	-22.81%	2,348	2,386	1.62%
Kidder	2,496	2,416	-3.21%	26,755,000	30,426,000	13.72%	1,760	1,927	9.49%
Morton	25,576	28,518	11.50%	364,034,000	396,552,000	8.93%	11,276	12,933	14.69%
Oliver	1,907	1,880	-1.42%	10,485,000	11,205,000	6.87%	1,105	1,506	36.29%
Totals	*108,179*	*125,622*	*16.12%*	*1,879,964,000*	*2,173,577,000*	*15.62%*	*78,418*	*95,202*	*21.40%*

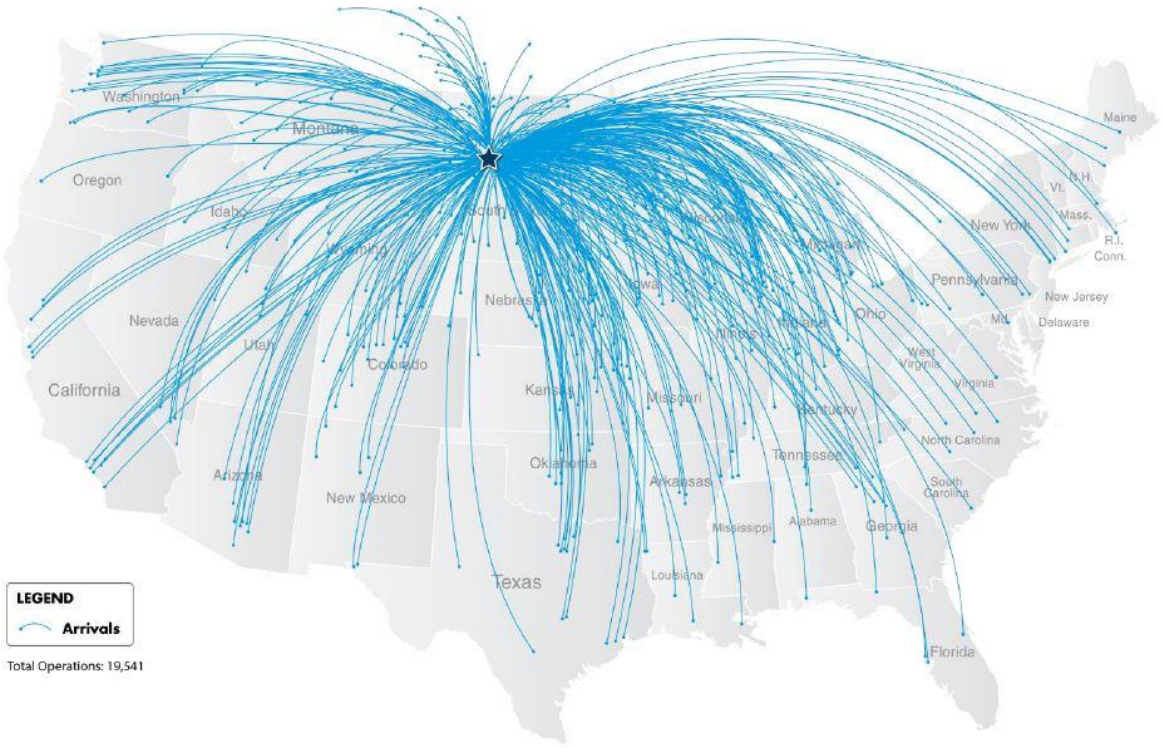
In addition to population, employment throughout a region offers another variable that can be used to understand the socioeconomic demographics of an airport's service area. Table 1-1 also summarizes the change in employment from 2005 to 2015 for the five Central North Dakota counties that surround the Airport. As illustrated in the table, overall employment rose 21.40 percent over the ten-year period with all counties experiencing an increase in job growth.

In an effort to gain a more detailed understanding of socioeconomic conditions throughout the service area, data was also obtained on the total retail sales for the five counties. As illustrated in Table 1-1, overall retail sales grew 15.62 percent from $1.87 billion in 2005 to 2.17 billion in 2015. Substantial growth was experienced in all counties except Emmons County (-22.81 percent), which experienced a reduction in retail sales.

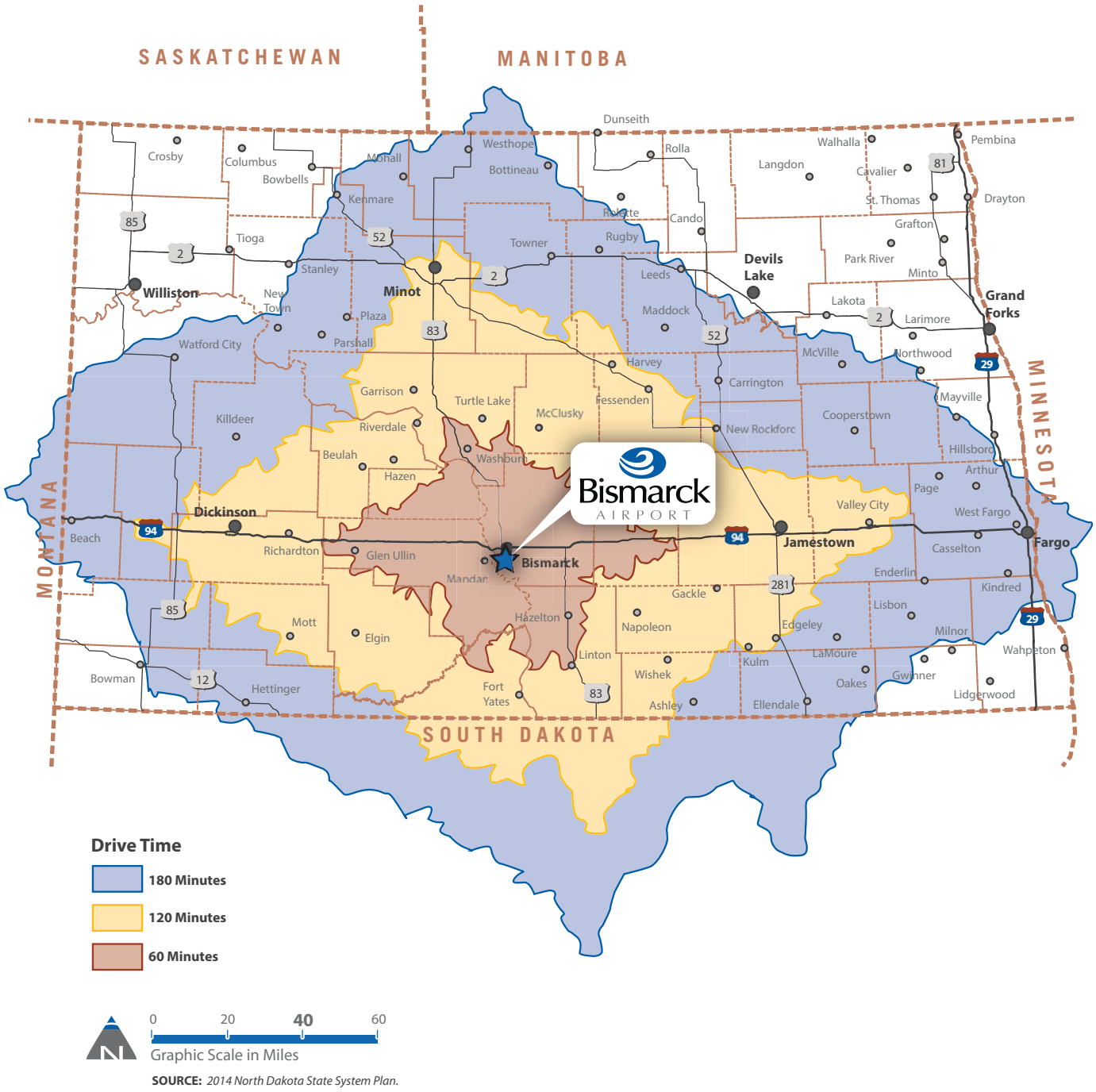
1.4.2. Airport Economic Impact

As identified in the *2015 North Dakota Statewide Aviation Economic Impact Study*, the Bismarck Airport generates approximately $279.7M in total economic impact into the local economy and contributes to the nationwide growth of airport economic impact. The benefits of the Airport truly go beyond the realm of city, state, or region. These benefits include, amongst other things, employment, sales, and revenue. **Table 1-2** and the accompanying graphic depict the financial impact that the Airport has on the community as well as the arrivals to Bismarck in 2014.

Table 1-2 Airport Economic Impacts (2015)									
	Employment			Payroll			Output		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Airport Management	24	16	40	$ 1,923,650	$ 774,790	$ 2,698,440	$ 6,966,207	$ 6,269,586	$ 13,235,793
Airport Tenants	403	379	782	$ 22,968,345	$ 18,587,940	$ 41,556,285	$ 76,502,687	$ 49,726,747	$ 126,229,434
Capital Investment	62	73	135	$ 4,102,808	$ 2,789,909	$ 6,892,717	$ 11,094,850	$ 9,097,777	$ 20,192,627
GA Visitor Spending	48	21	69	$ 1,186,848	$ 926,070	$ 2,112,918	$ 4,385,640	$ 2,806,810	$ 7,192,450
Commercial Visitor Spending	764	336	1100	$ 18,643,128	$ 14,606,824	$ 33,249,952	$ 68,838,160	$ 44,056,423	$ 112,894,583
Total Impacts	*1,301*	*825*	2126	*$ 48,824,779*	*$ 37,685,533*	*$ 86,510,312*	*$ 167,787,544*	*$ 111,957,343*	*$ 279,744,887*



Source: *2015 North Dakota Statewide Aviation Economic Impact Study*



SOURCE: *2014 North Dakota State System Plan.*

Exhibit 1-5 **Airport Service Area Map**

1.5. ORGANIZATION STRUCTURE

Since 1940, the City of Bismarck has served as the official sponsor of the Bismarck Airport. The City of Bismarck itself is organized into a five-member city commission which is elected at large. The commission is led by the Mayor of Bismarck. The Airport Director reports directly to the City Commission. The commission meets on the second and fourth Tuesday of each month. The management structure at Bismarck Airport consists of a traditional flat organizational model. As shown in **Exhibit 1-6**, the Airport Director is responsible for the day-to-day operations at the Airport. The director is supported by an Assistant Airport Director who has direct responsibility for three lines of business: operations, administration, and maintenance.

All lines of business contain subordinate responsibilities associated within the function of each service line. The airport management team is responsible for managing all airside facilities (runways, taxiways, and aprons) and landside facilities including the commercial airline terminal building and vehicle parking lots. The short and long-term parking areas are owned by the Airport, and daily maintenance is conducted by Airport staff. Capital planning and development as well as administration duties associated with the Airport's Passenger Facility Charge (PFC) program and federal grant assurances are also the responsibility of the management team. It should be noted that according to CFR Part 1542 the Airport Director is responsible for, along with the Transportation Security Administration (TSA), security of the entire Airport including the commercial airline terminal building. Other airport management team responsibilities include maintenance of all airfield surface pavements, snow removal, as well as hangar and tenant leasing and rental negotiations. Aircraft Rescue and Fire Fighting (ARFF) is the responsibility of the City of Bismarck and is staffed by the Rural Metro Fire Department who serve as contract employees. As of December 2015, the City of Bismarck employs approximately 22 employees at the Airport.

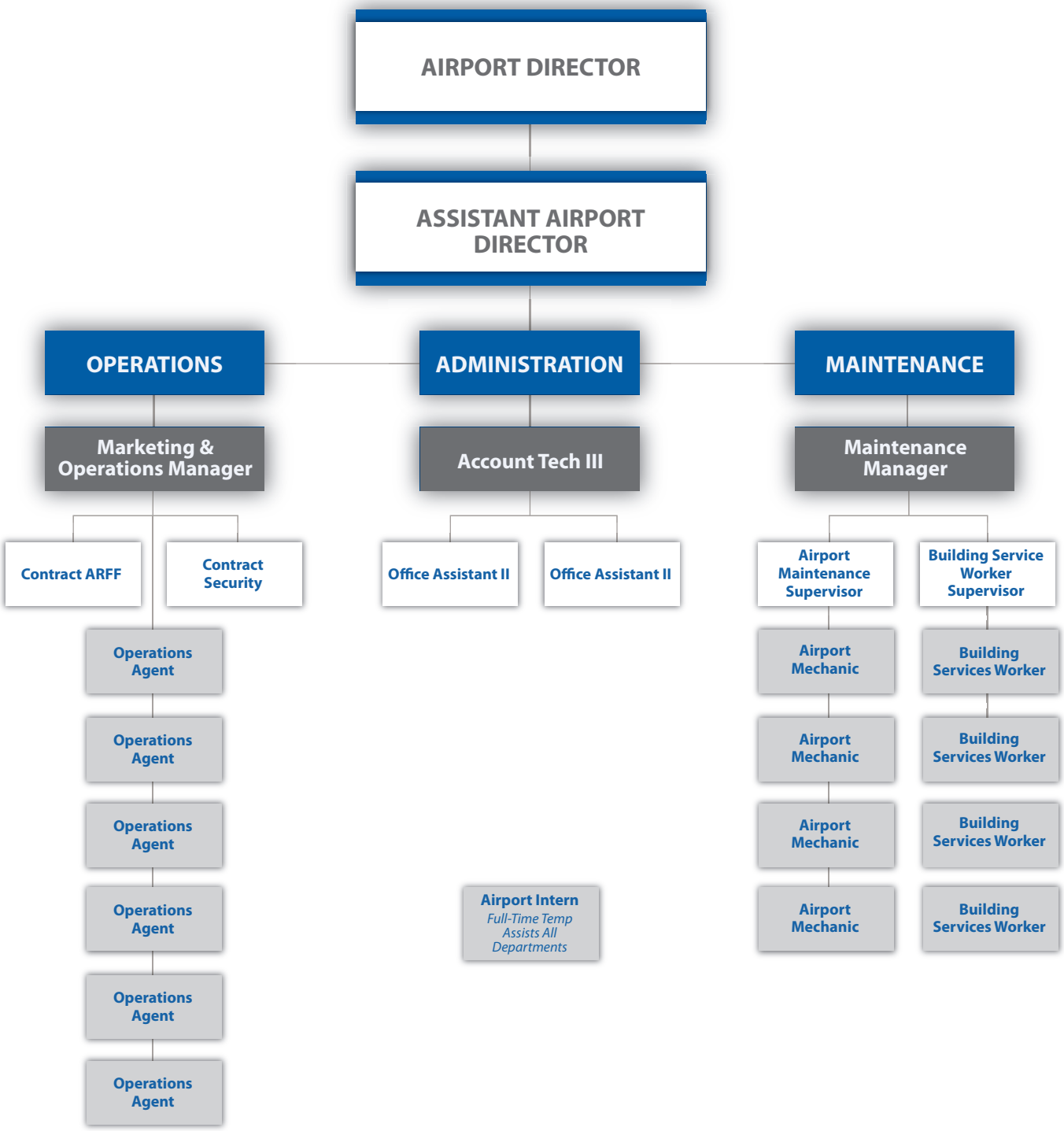


Exhibit 1-6 **Bismarck Airport Organizational Chart**

1.6. EXISTING FACILITIES

A detailed assessment of Bismarck Airport's existing facilities was conducted in November of 2015. This effort focused on the collection of information and photography associated with the current conditions of the Airport's airside, landside, and support facilities. This information is used during the development of facility requirements in order to help identify future improvements needed to meet anticipated future aviation demand. A summary of the Airport's existing airside, landside, and support facilities are presented in sections 1.6.1 through 1.6.3.

1.6.1. Airside Facilities

An assessment of Bismarck's airside facilities was conducted to determine their condition and individual specifications for future planning purposes. The airside facilities evaluated as part of this section include the runways, taxiways, and aircraft aprons.

1.6.1.1. Runways

The primary runway at the Airport, Runway 13-31, is oriented in a northwest/southeast direction and is 8,794 feet in length by 150 feet in width. Runway 13-31 is paved in asphalt, grooved, and the majority is considered to be in fair condition, with many large areas in poor condition. Reconstruction of Runway 13-31 is scheduled to be completed in calendar year 2017. Runway 13-31 is designed to meet Runway Design Code (RDC) category D-IV standards, meaning it is capable of accommodating aircraft with approach speeds less than 166 knots and wingspans between 118 and 171 feet. A wide variety of aircraft types are able of operate on the runway based on the weight bearing capacity of their main landing gear wheel configurations. The runway's pavement is rated to 130,000 pounds for aircraft with single wheel main landing gear configurations and up to 340,000 pounds for aircraft with dual wheel tandem main landing gear configurations. The main runway has an elevation variation of approximately 10 feet; the approach end of Runway

13 lies at an elevation of 1,654.4 feet MSL, while the approach end of Runway 31 lies at an elevation of 1,645.0 feet MSL.

The condition of pavement is evaluated using a system called the Pavement Condition Index (PCI), which categorizes pavement surface conditions using a variety of factors. Some of these factors can include skid resistance/hydroplaning potential, rate of deterioration, capacity, roughness, and structural integrity. On a scale of 0 to 100, pavements are rated using this PCI, with a score of 100 being in “excellent” condition, and a score under 10 considered to be “failed”.

Another method to measure the condition of pavement is by assigning a Pavement Classification Number (PCN), which is a similar analysis to the PCI which determines pavement strength and condition. PCN is determined based on two methods: The “using” procedure in which the largest Aircraft Classification Number of aircraft permitted to operate on the pavement surface is used to calculate the PCN and the “technical” evaluation in which the PCN is determined based on the allowable load rating of aircraft operating on the surface which takes into account such factors as frequency of operation and permissible pavement stress levels. The standard PCN scale ranges from 5 (assigned to the weakest pavements) to 110 (assigned to the strongest pavements).

In 2015, Applied Pavement Technologies (APTech) was contracted as a part of the North Dakota PCI Study project team to prepare a PCI and PCN analysis of Runways 13-31, 3-21, and all other airfield pavement surfaces. This analysis involved visual inspections of pavement surfaces, Falling Weight Deflectometer (FWD) testing, and an allowable load analysis of all airfield pavements. The analysis found Runway 13-31 has a PCI of 32-94. Appendix A of this document contains the full PCI report for the Bismarck Airport.

A summary of the data collected for Runway 13-31 is presented in **Table 1-3**.

Table 1-3 Runway 13/31 Data Summary	
Length	8,794 feet
Width	150 feet
Surface	Asphalt
Runway Design Code (RDC)	D-IV
Weight Bearing Capacity	Single Wheel: 130,000 pounds Dual Wheel: 180,000 pounds
Pavement Condition Index (PCI) Rating	32-94
PCN Value	42

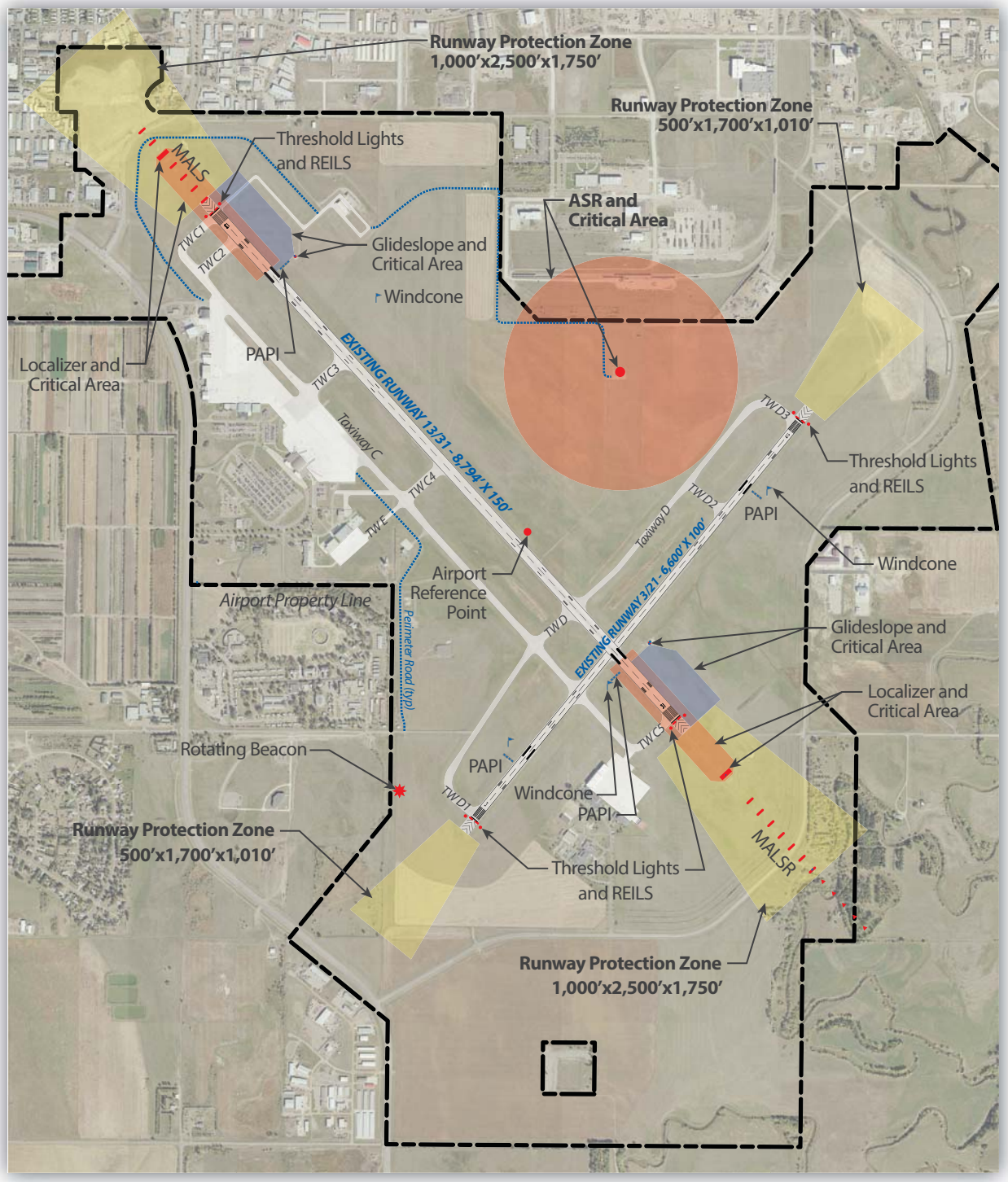
The crosswind runway at the Airport, Runway 3-21, is oriented in a northeast/southwest direction and is 6,600 feet in length and 100 feet in width. It is paved in asphalt, grooved, and is considered to be in fair condition. The runway's design meets RDC category C-II standards, meaning it is primarily designed for aircraft with approach speeds between 121 and 141 knots and wingspans between 49 and 79 feet. A wide variety of aircraft types are capable of operating on the runway based on the weight bearing capacity of their main landing gear wheel configurations. The runway's pavement is rated to 100,000 pounds for aircraft with single wheel main landing gear configurations and 140,000 pounds for aircraft with dual wheel main landing gear configurations. The approach end of Runway 3 lies at an elevation of 1,660.7 feet MSL, while the approach end of Runway 21 lies at an elevation of 1,661.3 feet MSL. APTech analysis found Runway 3-21 has a PCI of 54-90.

A summary of the data collected for Runway 3/21 is presented in **Table 1-4**.

Table 1-4 Runway 3/21 Data Summary	
Length	6,600 feet
Width	100 feet
Surface	Asphalt
Runway Design Code (RDC)	C-II
Weight Bearing Capacity	Single Wheel: 100,000 pounds Dual Wheel: 140,000 pounds
Pavement Condition Index (PCI) Rating	54-90
PCN Value	26

1.6.1.2. Taxiways

Taxiways are defined pavement surfaces that are used for aircraft to travel safely between the runway and other airfield destinations like hangars, terminals, and aprons. The taxiway system at the Airport is comprised of parallel taxiways that are located on the south side of Runway 13-31 and north side of 3-21. Several connector taxiways between the parallel taxiway and runways allow for movement to exterior areas of the airfield. Taxiway PCI numbers vary greatly from as low as 37 and 38 in some areas, to a high of 94, with most falling in the mid-seventies. **Exhibit 1-7** illustrates the taxiway system at the Airport.



0 1,000' 2,000' 3,000'

Graphic Scale in Feet

Bismarck AIRPORT Master Plan Update

Exhibit 1-7 **Airfield Layout**

1.6.1.3. Aircraft Aprons

Aprons, also known as ramps, are large paved surfaces that are specifically designed for the parking and servicing of aircraft. In addition, aprons provide aircraft access to hangars, Fixed Base Operators (FBOs), terminals, and locations to transfer passengers and cargo as well as fueling and maintenance. There are three primary aprons areas at the Airport, also identified in Exhibit 1-7.

The terminal apron, located adjacent to the commercial airline terminal building, is approximately 610,000 square feet and is used exclusively by commercial airline and large charter aircraft for the transfer of passengers to and from the commercial airline terminal building. The second primary apron, the general aviation apron, is approximately 750,000 square feet and offers access to both of the FBO buildings. This general aviation (GA) apron is used for a variety of purposes including the transfer of passengers and cargo between aircraft and the general aviation terminal building, parking for itinerant aircraft, and general aviation aircraft fueling. The third primary apron, the corporate aviation apron, is located south of the Airport terminal and is accessed from Taxiway E. At approximately 100,000 square feet in area, this apron is primarily used for loading and unloading of passengers using the corporate facilities. Another small apron is located near the Bravo hangars that is used for temporary parking when aircraft are not inside. Apron PCI values, during the 2015 study, reached from 29 in one small part to 97 and 98 over large areas of multiple aprons.

1.6.2. Landside Facilities

Landside facilities were evaluated for condition, utilization, and passenger convenience. The assessment of the terminal building included an in-depth focus on the primary functions within the building which helped identify those facilities requiring improvements

over the near-term planning period. Additionally, a review of the Airport's existing air cargo facilities is included in this section.

1.6.2.1. Terminal Building

As shown in **Exhibit 1-8**, the City of Bismarck's terminal, which opened in 2005, is a state-of-the-art passenger traffic facility that presents a simple, linear configuration. The terminal building consists of two levels. Level one is comprised of two halves, a secure and non-secure area. The non-secure area is located immediately to the west and includes the two primary entrance ways; public greeting space; rental car counters; baggage claim; ticketing; lobby seating; a small food and beverage concessionaire; vending; public restrooms; and the North Dakota Hall of Fame Museum. The secure area is located to the east and makes up the second half of level one. This area includes the baggage screening area; airline office space; airline storage; and tug lanes used for accessing aircraft located on the commercial apron. Consistent with level one, level two consists of a non-secure and secure area and is accessed by an elevator, escalator, and a two-sided staircase located in the midpoint of the terminal building. The non-secure area includes the airport administration offices; Transportation Security Administration (TSA) office; airport security office; TSA document check-in area; conference room; public restrooms; and airport storage room. Each of these facilities are connected by a linear hallway spanning the entire length of the terminal building. The level two secure area is accessed through the TSA checkpoint and includes a large non-partitioned holdroom which spans the entire length of the building. The holdroom is made up of public seating including traditional passenger seating clusters, business cubicles, as well as a passenger circulation area spanning the entire length of the second level. The level two secure area also includes a café/gift shop concessionaire; public restrooms; vending machines; game room; cell phone booster; flight information monitors; televisions; and free public Wi-Fi. Passengers access commercial aircraft using four passenger boarding bridges connected to the holdroom. Gates 1 and 2 are located along the north side of

level two while Gates 3 and 4 are located along the south side of the building. **Exhibit 1-9** depicts the terminal building floor plan.

The terminal building's exterior is a mixture of limestone, precast concrete, pre-finished metal panel and insulated glass. A large barrel vault with a standing seam metal roof is located at the center of the building with appendages that are largely symmetrical flanking each side. Roof mounted antennae are located to the east along the airside of the building. Passenger ingress/egress is achieved through a series of bi-parting automatic doors through vestibules with walk-off mats. The building's interior has a combination of porcelain tile and carpeted floors. Building walls are a combination of painted gypsum board, stone, glass, precast concrete panel, wood panels, glass railings, sprayed on acoustic wall treatment and porcelain tile. Ceiling treatment is mixture of acoustic lay in tiles, painted gypsum board and suspended wood panels. Four passenger boarding bridges are located on the airside connecting the passenger holdrooms and associated aircraft. It was observed that sunshine during afternoon hours penetrates the existing window glazing along the landside causing substantial glare for passengers and tenants alike, including the airlines and TSA. The installation of automated interior shade devices would easily remedy this issue and are addressed further during the facility requirements chapter. Consideration for location, height, opacity of shade material, color capability and seasonal adjustments are also addressed in Chapter Three.

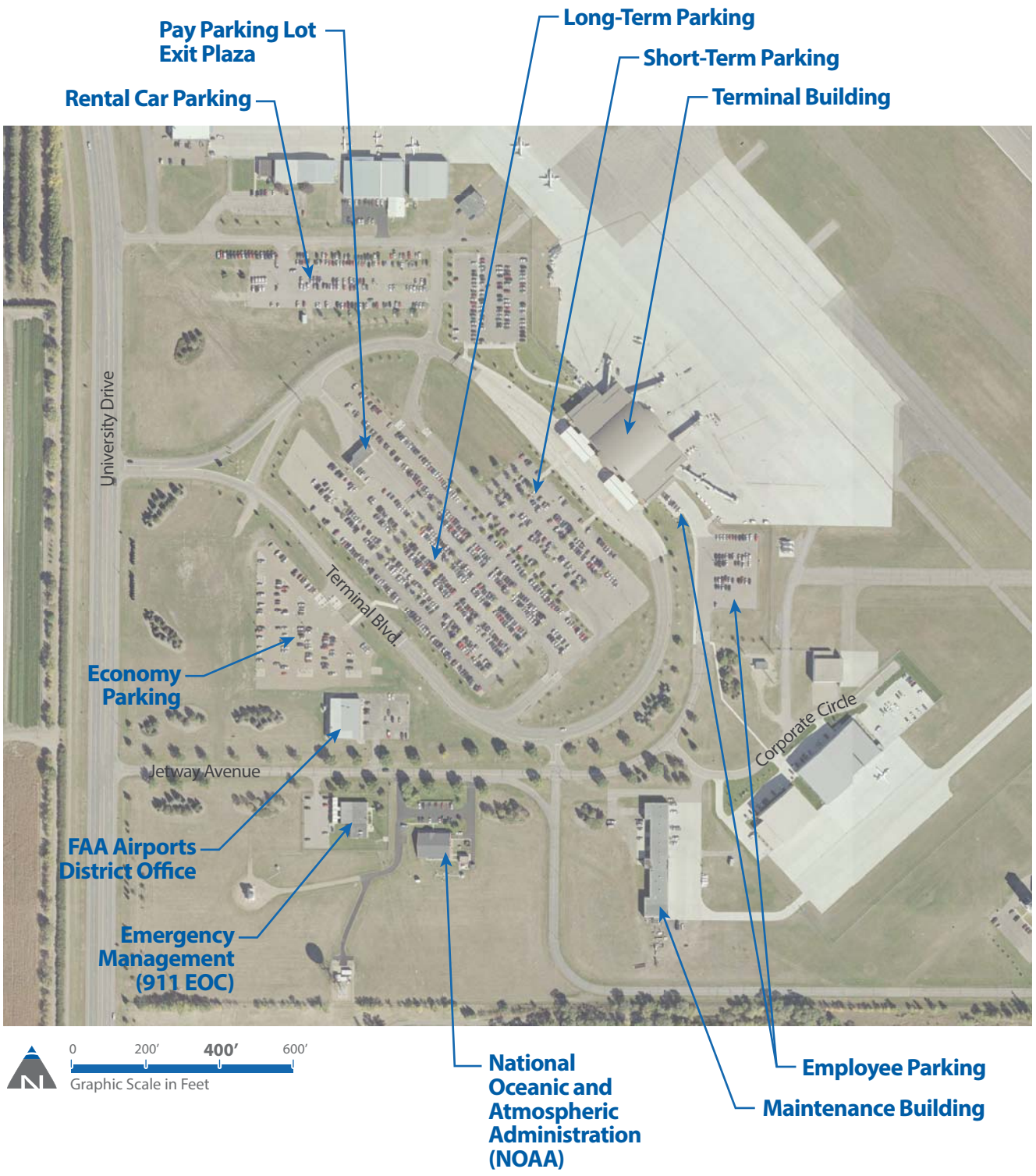
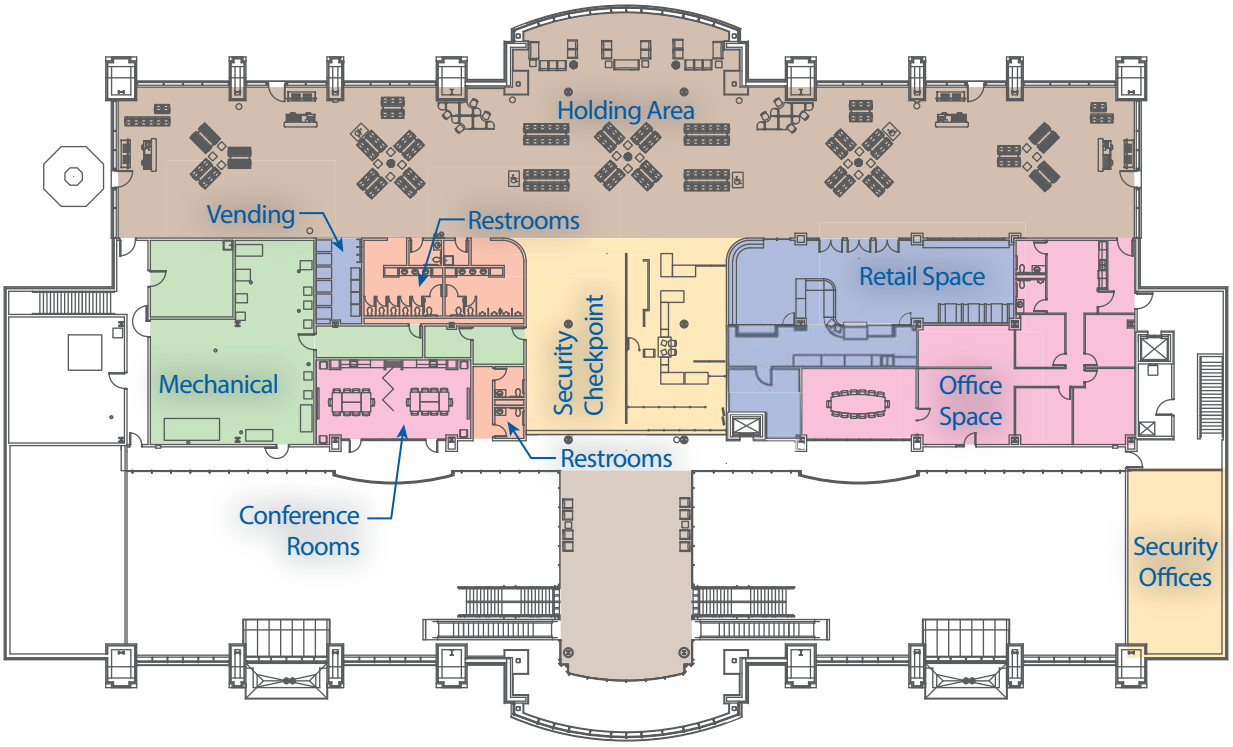


Exhibit 1-8 **Bismarck Airport Terminal Facilities Map**



▲ **Level Two**

▼ **Level One**

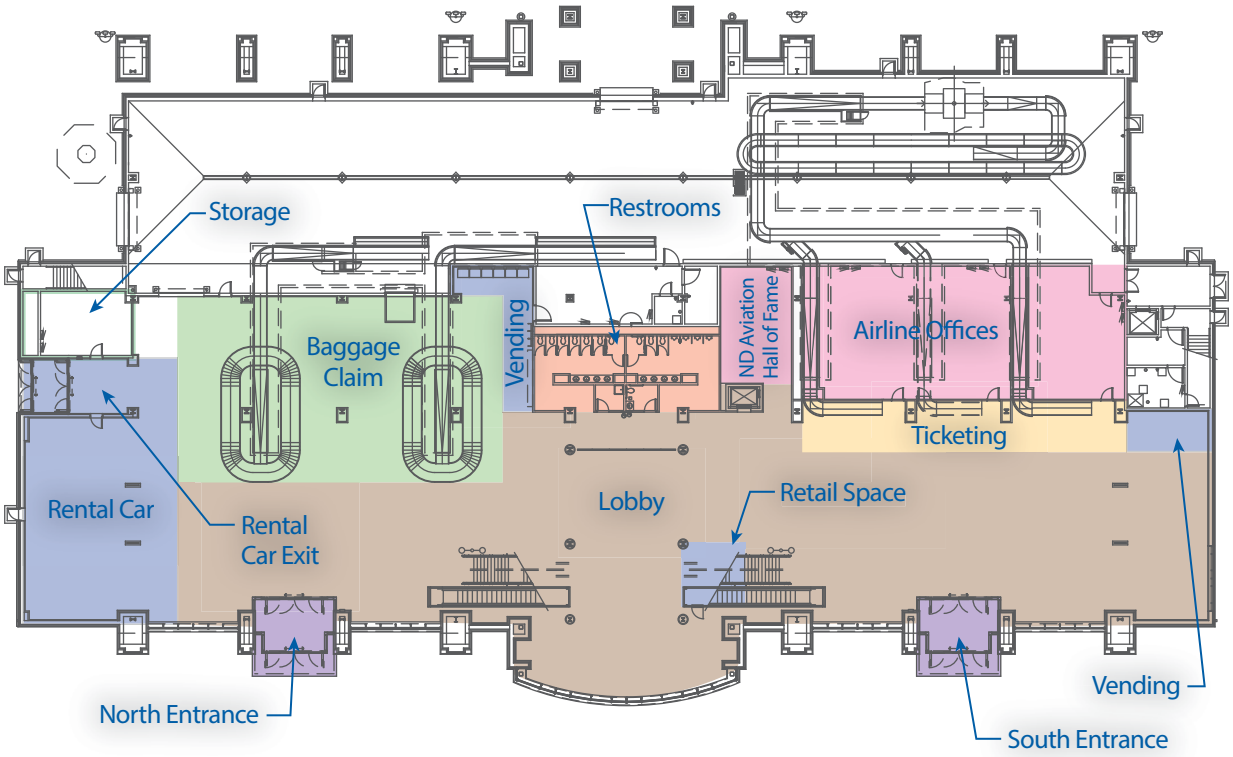


Exhibit 1-9 **Airport Terminal Building Levels One and Two**

Security Checkpoint

Located on level-two, the TSA security checkpoint is accessed by two sets of stairs, an elevator, and an escalator. A carpeted queuing area with stanchions is directly in front of the TSA document checker position. Sharing space in this area is a display for historical artifacts. It was observed during a busy period that the queuing depth is inappropriately sized. During that period, lines backed up towards the administration area circulation lanes. In addition, lines backed up towards the up escalator discharging passengers into congestion. This is a significant concern from an operational and emergency response perspective. In addition, the divestment area does not have enough roller area to avoid impacting screener throughput. TSA guidelines identify an 80-foot depth for the preferred checkpoint. This is measured from end of divestment roller to end of composure roller. The AIT and/or magnetometer screening device is roughly centered in this length. While this is the desired depth, it is not required. However, a straight in-line orientation of the rollers and machines directly determines passenger through-put. The Airport plans to expand the TSA security checkpoint to the north by reducing the width of the current passenger exit point from two lanes down to one lane. This will provide approximately 10 feet of additional space for the TSA to expand within. Longer-term, the Airport plans to further expand this area to accommodate additional passenger demand. Chapter Three will address the spacing requirements necessary to accommodate future passenger flow and be represented as an alternative developed as part of Chapter Four, Alternatives Analysis.

Holdroom

The passenger holdroom is located within the secure side of level-two. The holdroom is accessed directly from the TSA security checkpoint area. The holdroom area is a continuous space which serves four aircraft gates, each equipped with a passenger boarding bridge. The holdroom includes ample ceiling height and has glazed window openings on three sides. The shared common wall facing the checkpoint contains

vending, concessions, checkpoint exit, mechanical access, game room, restrooms and access-controlled building circulation. The center area is a continuation of the barrel vault ceiling running from front to rear of the terminal. The structural steel framing for a portion of the exterior wall is exposed. Waste receptacles are located throughout. Beam seating is clustered throughout the entire area as well as airline gate podiums equipped with monitors. Each passenger boarding bridge is accessed through a controlled access door; passengers can also be brought down through the north or south stairwell in case of mechanical failure. In addition to beam seating, floor displays and business cubicles are located in the center of the holdroom. Wall mounted advertising is located in various areas of the holdroom. Ceiling hung and wall mounted wayfinding is located at appropriate areas and is legible throughout. Observations made over multiple days indicate that the available holdroom seating is inadequate for aircraft presently being served. As a result, passengers are encroaching on required circulation and other adjacent areas. Chapter Three will address the current passenger seating limitations and identify the recommended space needed to facilitate adequate egress from this secure area.

Ticketing

Five airline ticket counters are located in the level-one non-secure area known as the ticket lobby. These counters are operated by Delta, American, Frontier, Allegiant, and United Airlines. Customer queue depth appears to be sufficient for current ticketing demands. Self-service kiosks are located at the United and Delta ticket counters for passengers' convenience. While this proximity can cause congestion at the counter, it does allow for the counters to operate with minimal staffing. Any future relocation of remote ticket kiosks would require data and power to be routed though the existing floor, walls or ceiling drops to operate. It should be noted that an additional area located directly adjacent to ticketing is available for future ticket counters. This area is presently being used as a display area. Within the secure area located behind the current ticketing area, minimal room exists to expand the TSA baggage screening area without significant

structural changes to the terminal building. Chapter Three addresses the need for additional expansion of the TSA screening area and the associated facilities impacted by a potential relocation.

Outbound Baggage

Outbound baggage is located immediately behind the airline ticket counters. Existing baggage conveying devices and screening operations were observed in addition to ground handling operations. Outbound baggage travels along a baggage belt directly to the TSA baggage screening area located in the level-one secure area. The baggage travels in a path below grade and up into the shared outbound baggage tunnel. The recent addition of the new TSA screening machines constrains the area currently used for TSA baggage screening. While the screening equipment appears to have an excellent throughput rate, the current system does not allow for any redundancy in the event that the device is offline. It was observed that multiple tug machines were operating in this space or were parked overnight thereby contributing to the congestion occurring in this area.

Baggage Claim

Two stainless steel inclined plane baggage claim devices are located on the north end of the terminal building within the level-one non-secure area. Both devices are fed from a baggage return belt located below the level-one floor. The devices were observed during a busy period and operated well. The operational age of a typical baggage devices can reach 25-30 years before maintenance costs become prohibitive. Thus, they should be operational for years to come if routinely maintained. The surrounding floor is porcelain tile, with wall mounted advertising displayed in certain areas. The floor area between the devices and the surrounding circulation/queue is appropriately sized for two larger aircraft arriving at the same time. The device length appears similarly right sized. Chapter Three will address the need for future expansion of the current baggage claim devices.

Rental Car

Three rental car companies currently operate at the Airport. These tenants include Avis, Hertz and Enterprise. All rental car counters and associated office spaces are provided directly adjacent to the baggage claim area. These counters are conveniently located for departing passengers. Each tenant space has back wall internally illuminated corporate signage. The office area is appropriately sized for current traffic levels. The three tenant spaces are connected with a tenant wall dividing them. A fourth potential tenant space is available across the vestibule circulation area. As of December 2015, the Airport has contracted with the current rental car companies to construct a consolidated rental car Quick Turn Around Facility (QTA) which is used to wash cars, support general maintenance, and prepare cars for rental. This area is located immediately west of the existing rental car ready return parking lot near University Drive (Highway 1804).

Concessions

A pre-security concession space is located within the level-one non-secure area directly underneath the staircase located at the midpoint of the terminal building. A variety of retail and food/beverage offerings are available. This concession area is somewhat limited in visibility throughout level-one but is sized sufficiently for the need. The largest concessionaire, the Fly and Buy Bar/Café, is located within the level-two secure area immediately south of the TSA security checkpoint. The Fly and Buy has a wide variety of offerings include food/beverage, souvenirs and retail. Both booth and counter seating are provided within this enclosed space. In addition, a single row of high-top seating is available just outside the tenant wall.

Restrooms

Public restrooms are located on both levels of the terminal building. These restrooms include men's, women's and family facilities. Each restroom is equipped with porcelain tile floors and wainscoting which provides long lasting durability and ease of maintenance.

All restrooms are ADA compliant for size, and wall mounted wayfinding is appropriately located for ease of use. During peak deplaning periods, those restrooms located within the level-two secure area were observed to be insufficient to meet current demand. Based on International Air Transport Association (IATA) recommendations, approximately three times as many plumbing fixtures are needed to accommodate passenger demand. Moreover, as the national trend for use of larger aircraft continues, the need for larger restrooms equipped with additional stalls will be required to meet the desired level of service. Chapter Three will address the number, size and location of future restroom needs over the 20-year planning period.

Administration/Conference

Airport administration, TSA, and law enforcement offices are located on the non-secure side of level-two. These offices are accessed by stairs, escalators and elevators which meet accessibility requirements. The administrative office area includes private offices, open reception area, administrative conference room, break room, and private restrooms. A second conference room is located north of the TSA checkpoint and is frequently used by TSA and other public meetings. This public conference room is adequately sized for a variety of public meetings. All areas appear to appropriately sized for present and future uses. Wayfinding is located on both levels. With the exception of the restrooms, all areas have carpeted floors, painted gypsum walls and acoustic ceilings with lay-in lighting.

Meet and Greet Area

A meeter/greeter area is located on both level-one and two within the non-secure area of the terminal building. On level-one, this area is located at the base of the staircase and includes multiple soft-seated chairs within a well-decorated environment. This carpeted area also includes multiple glazed windows which provide ample lighting to the area. An additional meeter/greeter area is provided at the top of the staircase adjacent to the TSA security checkpoint. This area consists of a few soft-seated chairs with small tables

between seating. It was observed that the connectivity between both meeter/greeter areas functions well and appears to be sufficiently sized for present and future needs.

Terminal Curbfront

The primary access to the commercial terminal is located off University Drive (Highway 1804) by way of a curving road approaching the southwest corner of the terminal. Sightlines to the terminal and general wayfinding are adequate for arriving vehicles. The approach road splits into four lanes for traffic; two drop off lanes, two for through traffic and separate lane for taxis, vans and shuttles. General observations of traffic and queuing found the configuration to be very effective. The drop off lanes had an appropriate amount of curb frontage to provide direct access for passengers. In addition, a masonry and steel canopy with a curved polycarbonate covering provides weather protection and general wayfinding. The canopy is in 2 parts and is interrupted by a curved (in plan) central portion of the terminal. The interruption was to maintain views of adjacent property from the security checkpoint second level. Canopy lighting provides adequate evening lighting levels. Roof mounted snow guards retain accumulated snow for pedestrian safety. Benches, waste receptacles, and general landscaping are also provided.

1.6.2.2. Vehicular Parking and Pedestrian Access

Vehicular parking at the Airport consists of nearly 1,900 total surface parking spaces. Of these, 1,119 spaces are for public parking while the remaining 580 spaces support employee, FBO and rental car parking needs. Surface fee-based parking is provided for short and long-term parking as well as economy parking. The short-term parking lot is located immediately west of the terminal building and consists of 282 parking spaces. The short-term parking area is used primarily for hourly passenger services. Long-term parking is located further west of short-term parking and is separated by a grass median and three control-arm gates located along the grass median. The long-term parking lot contains 660 parking spaces. This lot is intended for overnight and extended stays when

flying out of the Airport. The economy lot is located furthest from the terminal building and includes 177 parking spaces. This lot was constructed for weekly and monthly use and provides a less expensive alternative for long term parking. Information provided by the airport indicates that the far western end of the surface parking lot is approximately 1,000 feet from the terminal building entrance. IOTA standards for Level of Service (LOS) have indicated that 1,000 feet is the maximum walking distance for a LOS "C" grade. In short, a C grade balances passenger expectations and airport cost/maintenance which typically is an acceptable threshold.

An additional parking lot located to the north provides parking for the rental car companies operating at the Airport. This lot includes the recently developed QTA facility which is used to provide light maintenance, car washing, storage and preparation for new rentals. The total rental car parking consists of 435 parking spaces. Of these 435 spaces, 76 are designated as ready spaces, 39 as return spaces, and 320 as storage spaces.

An airport employee parking lot containing seven parking positions is located along the south side of the terminal building. This lot is used by Airport Administration staff. A second lot is located further to the south and contains 80 parking stalls that are used by the employees who work inside the terminal.

The FBOs and other major airport tenants located at the Airport require large parking areas to meet customer demand. These parking areas are located adjacent to each facility and combine for 208 parking spaces. It should be noted that there are other smaller paved areas around the airport which are used for parking; however, these areas are not designated nor labeled as public parking. **Table 1-5** summarizes the vehicle parking spaces at the Airport.

Table 1-5 Vehicle Parking Capacities	
Parking Lot	**Spaces**
Short Term	282
Long Term	660
Economy	177
Rental Car	435
Employee	87
FBOs	208
Other	48
Total	***1,897 Parking Stalls***

Based on information provided by the Airport, surface parking is limited during peak travel periods. Currently, the Airport utilizes a grassy area located immediately behind the economy parking lot to accommodate additional vehicles during peak travel periods. This area is delineated by roping and signage. Pedestrian access is provided via painted walkways from each lot to the terminal building. Pavement markings are slightly raised to connect pedestrians from the parking area and the terminal sidewalk. In addition, stop signs are provided at the cross walks providing traffic calming and pedestrian safety. Handicapped parking spaces are located within each paved parking lot along the side closest to the terminal building. With exception of the grassy overflow parking area, all surface parking lots consist of bituminous materials and are in fair condition. During the inventory collection process, all paved lots were observed to be largely full. In addition, one unpaved grassy area located along the north end of the short-term parking lot closest to the terminal has an underground geothermal well field. Previous engineering reports prepared for the Airport indicate that vehicle parking in this area is permitted, provided no excavation is completed as a result of the project. The well heads for the geothermal system are housed slightly below the surface. Without a significant reconfiguration of

existing infrastructure, the surface parking area is largely at maximum capacity. The aforementioned grass area and geothermal field appear to be remaining areas for customer parking; however, initial observations of this approach indicate that the costs would be considerable. The identification of additional parking areas and their associated costs will be addressed in the Facility Requirements Chapter of this master plan.

1.6.2.3. Air Cargo

Air Cargo operations at Bismarck are important addition to the daily activities of the Airport. Fed Ex operates Cessna Caravans filled with packages and flats on feeder routes to larger hubs. These aircraft and pilots operate from the apron area between the main general aviation ramp and the terminal apron. In addition, UPS and United States Postal Service (USPS) also have a significant presence. As of 2016, these operations are served by Alpine Air's Beechcraft 1900s, but this can change as contracts evolve. Occasionally, there are also other smaller cargo operators that move goods in and out of Bismarck using Metro III and Beechcraft 1900 aircraft. This area is accessed by Maverick Avenue from University Drive. Bismarck Airport's average monthly cargo weight totals are approximately 660,000 pounds, and this figure increases significantly during the peak seasons. Cargo demand is anticipated to continue increasing, and thus, fleet changes, in the form of number or aircraft size, are expected to follow.

The Northern Plains Commerce Center (NPCC), located immediately north of the Airport, is an industrial park with access to the Interstate system and multiple rail lines. This area has been identified as a possible cargo expansion location in the future.

1.6.3. Support Facilities

A number of airport support facilities were reviewed to determine their condition and function at the Airport. These include aircraft fueling, navigational aids, weather observation systems, Airport Rescue and Fire Fighting (ARFF) equipment, Snow

Removal Equipment (SRE), electrical systems, and airport access roadway. The following section provides an overview of each support facility.

1.6.3.1. Aircraft Fueling and Storage

The fuel farms at the Bismarck Airport are located southeast of the airline terminal, adjacent to Taxiway C. The northernmost fuel farm is owned by Executive Air Taxi Corporation (EATC) and has a total of 4 tanks. They have one (1) 500-gallon diesel tank for use in fuel trucks and other vehicles. For aircraft fuel storage, EATC has two (2) 15,000-gallon Jet-A tanks and one (1) 15,000-gallon 100LL tank. The fuel farm to the south is owned by Bismarck Aero Center (BAC) and contains a total of five tanks. Three (3) of the tanks store Jet-A, with a combined total of 52,000 gallons. The other two (2) store 17,000 gallons of 100LL and 500 gallons of diesel. In addition to this fuel farm capacity, the BAC FBO also employs fuel trucks that give them another 13,000 gallons of Jet-A capacity and 1,750 gallons of 100LL. All of these products are primarily used for commercial and general aviation operations on the terminal and GA ramps, and are owned by the respective FBOs. The two fuel sites have EPA-approved secondary containment measures to help contain fuel in the event of an accidental leakage. Jet-A and 100LL fuel at the Airport is available 24 hours per day, seven days a week, 365 days a year through the Airport's FBOs.

1.6.3.2. Navigational Aids

Navigational aids (NAVAIDs) are forms of visual devices and electronic equipment that assist pilots when navigating to and around an airport. NAVAIDs can be lights, signs, pavement markings, and antennas and are most beneficial when an aircraft is on approach to land and/or in conditions when visibility is limited such as at night and in inclement weather. While most NAVAIDs are ground-based equipment installed on an airfield, some are satellite-based that provide navigational signals through the Global Positioning System (GPS) to properly equipped aircraft. This section reviews both the

ground-based and satellite-based visual and electronic NAVAID equipment that is used for aircraft operations at the Airport.

Visual NAVAIDs – Visual NAVAIDs are considered to be lights, signs, and pavement markings that provide visual navigational information to pilots when on approach to land and when taxiing after landing or prior to takeoff. The following section summarizes the visual NAVAIDs that are located at the Airport:

- **Rotating Beacon –** A rotating beacon is a high intensity light that rotates 360 degrees and is operated during low visibility situations such as at night and in inclement weather to assist pilots in identifying the location of an airport from the air. Rotating beacons are equipped with a green and white lens separated 180 degrees from each other so that alternating green and white flashes can be viewed from the air signaling to pilots that an airport is available for public use. The rotating beacon at the Airport is located on a freestanding tower just west of the Runway 3 end.
- **Wind Indicators –** Wind Indicators (also known as wind socks or wind cones) are orange cone-shaped fabric devices that visually indicate wind strength and direction. Wind indicators are most beneficial to pilots prior to landing and during takeoff when aircraft are most impacted by surface winds; as such, wind indicators are typically located approximately 1,000 feet from the end of a runway if it serves air carrier aircraft and lighted if an airport is open to commercial air carrier operations at night. Four wind indicators are located at the Airport, all of them being lighted: one north of Runway 13-31 near the aprons, which serves the 13 end, one near the 31 end, one serving the Runway 21 end, and another one located near the Runway 3 end.
- **MALSR –** Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) assists in visually confirming the centerline of a runway prior to its threshold. MALSRs are typically equipped of with a series of light bars, each equipped with five lights that are preceded by

a series of sequenced flashing lights. MALSRs are most beneficial at night, in inclement weather, when visibility is limited, and/or when lights from the surrounding environment have the potential to make visual identification of the runway threshold challenging, such as when an airport is located in a metropolitan area. At Bismarck, a MALSR is located at the approach end of Runway 31, while the 13 end has only a MALS. On Runway 31, the approach lighting segment intensity can be controlled by the pilot.

- **Precision Approach Path Indicator (PAPI) –** Precision Approach Path Indicators (PAPIs) are approach lighting systems that indicate the correct glide slope angle to a runway through a series of angled white and red lights located adjacent to the touchdown zone aiming point marking on a runway. PAPIs are typically comprised of a two- or four-light unit in which combinations of the lights indicate if an aircraft is above, below, or on path with the correct glide slope. A four-light PAPI unit is located at each end of Runways 13-31 and 3-21. The PAPIs serving the Runway 13 end are FAA-owned, while those on 31, 3, and 21 are owned by the Airport.
- **Runway Edge Lighting –** Runway edge lighting is an important visual navigational tool as it designates the edge of a runway pavement surface when conditions limit visibility such as at night and in inclement weather. Runway edge lights are white except for the final 2,000 feet of an instrument runway when lighting is amber in color to help pilots identify the end of the pavement surface. Runway edge lights are classified into three types of lighting systems based on the number of illumination intensity settings. High Intensity Runway Light (HIRL) systems have the greatest illumination intensity with five light settings while Medium Intensity Runway Light (MIRL) systems have three light intensity settings. Low Intensity Runway Light (LIRL) systems offer only a single light intensity setting. Runways 13-31 and 3-21 are each equipped with a HIRL system.
- **Runway Pavement Markings –** While runway pavement markings are not typically considered as a NAVAID, they offer pilots with another visual confirmation of the touchdown zone, centerline, and boundaries of a runway

surface. Runways with visual approaches many only require a few essential markings while runways with precision approaches may require additional markings to help pilots designate the touchdown zone and runway threshold. Each end of Runway 13-31 is equipped with precision pavement markings that include those identifying the threshold, runway designation, aiming point, touchdown zone, centerline, and the sides of the runway. Runway 3-21 is equipped with similar precision markings on each end as well.

- **Airfield Signage –** Airfield signage is an important visual navigational aid that helps identify the locations of runways, taxiways, and aprons as well as provide noise abatement instructions and other airfield information to pilots. Airfield signage at the Airport includes runway distance remaining signs, directional signs, runway holding signs, and surface-painted hold signs.
- **Taxiway Edge Lighting –** Taxiway edge lighting is similar to runway edge lighting in that it helps identify the edge of taxiway surfaces when visibility is limited such as at night and in inclement weather conditions. Taxiway edge lights are blue and are typically installed with three illumination intensity settings at airports that support commercial airline service. The taxiway edge lights installed at the Airport are a Medium Intensity Taxiway Light (MITL) system that is equipped with three illumination intensity settings.
- **Electronic NAVAIDs –** Electronic NAVAIDs are important navigational tools in that they allow properly equipped aircraft to conduct landings when conditions impact the ability of a pilot to visually navigate a landing into an airport such when low cloud ceiling and/or inclement weather is presented. Electronic NAVAIDs are also used to complement visual NAVAIDs so that the capability for aircraft to arrive and depart from an airport can be maintained in both visual flight rules (VFR) and instrument flight rules (IFR) weather conditions. Electronic NAVAIDs operate by transmitting electronic signals that are received by avionics equipment installed in an aircraft. The signals transmitted by the electronic NAVAID may provide position, altitude, and speed information which allows a properly trained and certified pilot to navigate an aircraft to the Airport using only the instrumentation in the cockpit

if needed. Electronic NAVAIDs range from ground-based antennas installed at an airport to satellites transmitting GPS signals. The following section summarizes the electronic NAVAIDs that are utilized for aircraft landings at the Airport.

- **Runway Visual Range (RVR) –** The RVR is an estimation of how far down a runway a pilot can expect to see. It is calculated using ambient light levels and the intensity of the runway lights. The RVR distance values are reported in feet. RVR is used as one of the main criteria for minima on instrument approaches; in most cases a pilot must attain visual location of the runway before the aircraft. The maximum RVR range that is reported is 6,000 feet. RVR readings are reported by ATC and weather reports such as ATIS and METARs. The RVR equipment at Bismarck Airport is located adjacent to Runway 13-31.
- **Automatic Dependent Surveillance - Broadcast (ADS-B) –** The ADS-B is an integral part of the US Next Generation Air Transportation System (NextGen) program. It essentially replaces secondary radar facilities and allows broadcasting of aircraft ground and air position reporting. Although it is a ground-based antenna system, the system can be used to provide automated traffic separation around uncontrolled airport environments. The on-board equipment also has the capability to give weather reports and weather radar information to pilots in the air. The ADS-B that serves the Airport is located at the Mandan Airport, 6 nm to the west.
- **Instrument Landing System (ILS) –** An Instrument Landing System (ILS) is comprised of two antennas that provide horizontal and vertical positioning guidance information to properly equipped aircraft on approach to land on a runway. The first antenna, a localizer, is positioned beyond the far end of a runway and transmits a signal down the length of the runway and beyond to help aircraft on approach to align horizontally with the runway centerline. The second antenna, a glide slope, transmits a signal that guides aircraft vertically with the proper approach angle towards the landing threshold. An ILS is the most precise electronic navigational guidance system of all electronic

NAVAIDs.

There are different categories of ILSs based upon the navigational accuracy of the transmitted signals, the allowable decision height at which visual confirmation of the runway is needed in order to land, and the minimum visibility needed to conduct an approach. The standard ILS, Category I, allows a properly equipped aircraft to conduct a landing when the cloud ceiling height is not lower than 200 feet and the visibility is not lower than 1/2 mile. At Bismarck, Category I ILS systems are installed at the approach end of Runways 13 and 31.

- **Global Positioning System (GPS) –** The Global Positioning System (GPS) is a satellite based navigational system that transmits location signals to properly equipped aircraft so that location, altitude, direction of travel, and speed can be determined. GPS offers the ability for aircraft to conduct non-precision approaches to runways that are not equipped with ground based navigational equipment. At Bismarck, Area Navigation (RNAV) GPS approaches can be conducted to Runways 13, 31, 3, and 21.
- **Very High Frequency Omni-directional Radio Range (VOR)** – A VOR beacon is a ground based navigational system that emits radio signals to help an aircraft calculate its bearing. VORs are utilized for non-precision approaches and operate by directing an aircraft to the general vicinity of an airport upon which the pilot must be able to visually identify the airfield prior to maneuvering for a landing. The VOR used for navigational and approach purposes is located 2.9 nm from Runway 31 and has a published circling approach to all runways.

1.6.3.3. Weather Observation Systems

Weather observation equipment is often installed at an airport to record and disseminate accurate and timely weather conditions since aircraft operations can be directly impacted by local weather conditions. Two types of weather observation equipment are often

installed at airports: Automated Surface Observing Systems (ASOSs) and Automated Weather Observing Systems (AWOSs) with the components of each system relatively similar. At the Airport, an AWOS III unit is located adjacent to the Runway 13 PAPI, approximately 1,100' from the approach end of the runway. The AWOS unit is equipped to measure temperature, dew point, barometric pressure, density altitude, visibility, precipitation accumulation, cloud ceilings, sky cover, present weather conditions, and wind data such as speed, direction, and gusts. This system also allows augmentation by observers for conditions such as unusual precipitation (snow pellets, hail, etc.), smoke and volcanic ash.

1.6.3.4. Snow Removal Equipment (SRE) Facility

The SRE facility is situated directly south of the terminal building and auto parking area, with access to Taxiway C. It is used for the storage, servicing, and repair of vehicles and equipment utilized for maintaining the airfield. The SRE facility, at approximately 16,000 square feet, currently is undersized based upon existing eligible Airport equipment. Given the limited space for snow removal equipment, the Airport uses two other buildings to store out-of-season equipment. The primary storage building is able to house most of the Airport's plows, blowers, brooms, sand trucks, pickups, tractors, and spare attachments miscellaneous equipment, and sand storage. It also houses a large garage space for repair and routine maintenance of SRE equipment. Within the existing building are many snow removal crew conveniences. Some of these amenities include restrooms, office space, a crew rest area, and internet service. Outside the building there are storage tanks for products used by the Airport to sustain the operations on the airfield. Some of the products stored here are liquid runway deicer, glycol, used waste oil, diesel fuels, and unleaded auto gas. These are all used exclusively by airport staff and are not for sale to airfield tenants.

1.6.3.5. Aircraft Rescue and Fire Fighting (ARFF) Facility

The Airport holds a Federal Aviation Regulation (FAR) Part 139 operating certificate, meeting the requirements of a Class I airport capable of serving scheduled and unscheduled operations of small and large air carrier aircraft. The Airport meets ARFF Index B requirements for firefighting equipment and fire extinguishing agents and is capable of Index C requirements if necessary.

The ARFF facility is a 6,500-square-foot building located adjacent to Taxiway C, just northeast of the ATCT. It is equipped with three vehicle bays and is used for the storage of trucks and emergency vehicles. These bays currently house two Oshkosh vehicles, one command vehicle, and one ARFF foam trailer. Additional storage areas are used for surplus equipment, supplies, and fire-fighting gear. The ARFF building also houses emergency communications equipment as well as a backup generator, and personnel areas such as a restroom with shower facilities, a training room, fitness area, break area with a microwave and refrigerator, and office space.

1.6.3.6. Airfield Electrical Vault and Generator

A constant supply of power to airfield lighting and navigational equipment is essential for an airport to support continual aircraft operations. Two elements that are necessary to supply a continual source of power to airfield electrical components are an airfield electrical vault and a power generator. Airfield electrical vaults are structures designed to house transformers, lighting panels, constant current regulators (CCRs), relays, and other electrical components necessary to keep an airfield's electrical infrastructure operational. Airfield power generators are natural gas powered and provide a source of backup electricity in the event of an off-Airport public utility power failure.

Since airfield electrical vaults and generators are often connected to the same circuit, they are generally located in close proximity to one another to provide a centralized

location for maintenance and accessibility. At the Airport, the generator that serves limited functions in the terminal building is located to the north, next to the cooling tower for the heating/cooling system. The south airfield electrical vault is on the west side of the airfield on the extension of Burleigh Avenue, just past Gate 100. This vault powers the crosswind runway and parallel taxiway, as well as a portion of Taxiway C. The north vault and the airfield generator are located in the operations building located north of Gate 55. This vault powers the main runway and a portion of Taxiways C and B.

1.6.3.7. Airport Access Road

Bismarck Airport is located immediately off University Drive (Highway 1804) approximately four miles from Interstate 94. The primary entrance into the Airport is provided by circular terminal roadway known as Terminal Boulevard. University Drive is located on the western side of the airport and the entrance to the Terminal environment is marked by a large Bismarck Airport sign. To the east, the Airport is accessed via Airway Avenue. Yeagan Road dead-ends at University Drive to the south side and continues past Morrison Avenue, located on the north side of the Airport. Access to the north end of the airfield is provided by Airport Road, which connects to the eastern side of the Bismarck Expressway (Highway 810) and Airway Avenue. This northern portion of Airway Avenue does not connect directly to the portion on the east side of the airfield but terminates in the west at Airport Road. Approximately 25 various locations around the Airport have gate access to the airfield.

1.7. GENERAL AVIATION BUSINESSES AND TENANTS

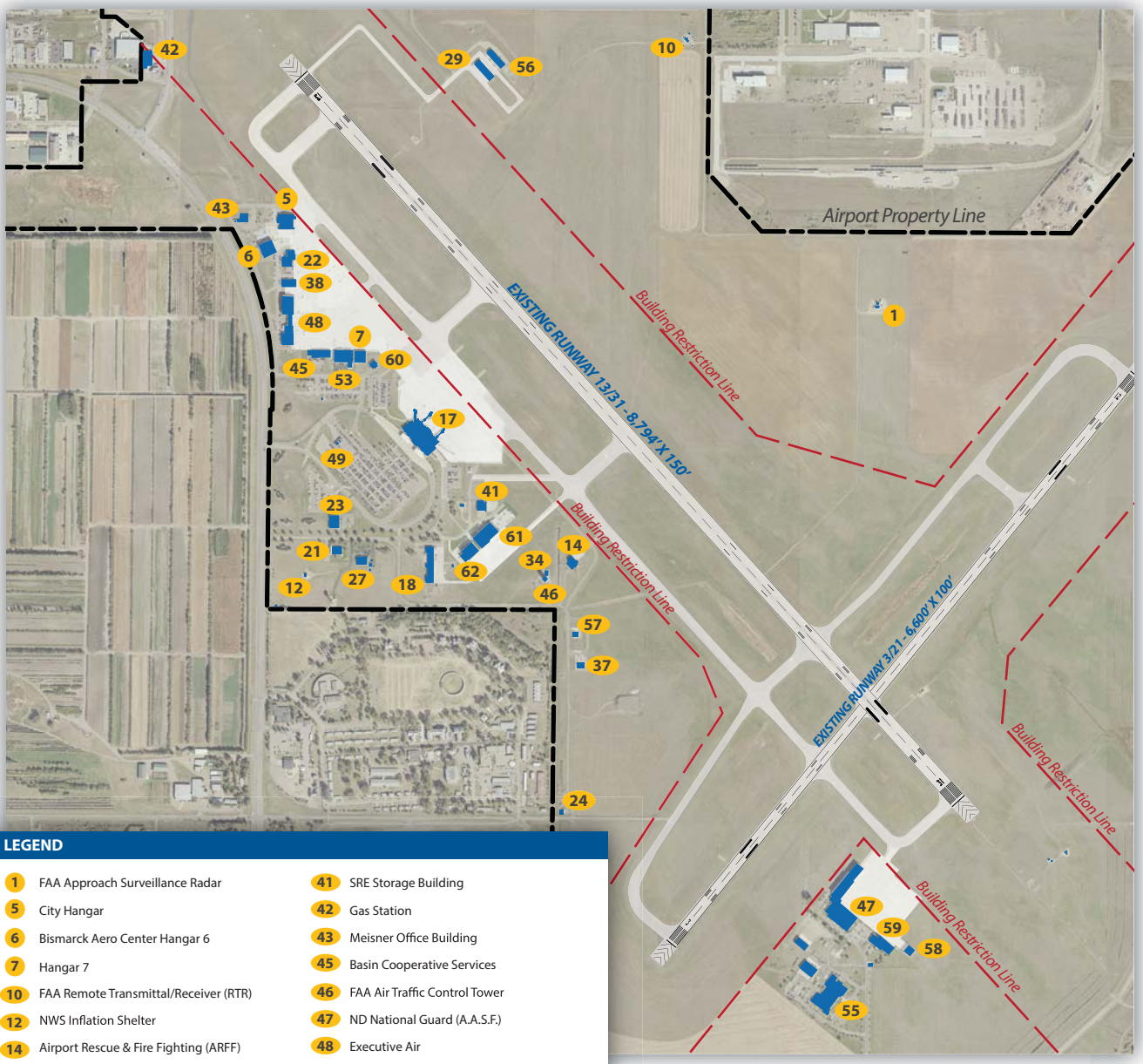
Bismarck is home to two Fixed Based Operators (FBOs); the North Dakota Aeronautics Commission; North Dakota Fish and Game; North Dakota State Highway Patrol; FedEx; Basin Electric Corporation; MDU; the US Army National Guard; FAA and Motix. The FBOs, Bismarck Aero Center and Executive Air, are located on the general aviation ramp area north of the terminal. Both FBOs provide a wide variety of services including general aircraft maintenance, avionics, charter brokerage, aircraft rental, flight instruction, fueling,

aircraft sales, ground school, hangar storage and pilot services. The Bismarck Aero Center complex also houses the North Dakota Aeronautics Commission staff offices.

Both Basin Electric and MDU are located south of the terminal building, each utilizing its own large corporate hangar adjacent to Taxiway E. Further south, the North Dakota Army National Guard facility is located on the south end of the airfield and is the base of several military aircraft including the UH-60 Blackhawk, UH-72 Lakota, and one C-12 fixed wing aircraft. The Civil Air Patrol (CAP) relocated to Mandan Airport in 2015.

1.7.1. General Aircraft Storage

The many hangars located around the general aviation area at the Airport are used by based and itinerant aircraft for recreational and business flying purposes. Many of the hangars are either owned by the FBOs for their use or are leased to tenants for their flight operations. One hangar that doesn't fit this narrative is the City of Bismarck-owned hangar on the extreme north end. This hangar has surpassed it useful life and although it is currently being used for aircraft storage, it is slated for removal in the near future. South of the terminal, adjacent to the SRE building, are two private corporate hangars. These buildings house some of the larger corporate operations on the field including MDU and Basin Electric. Another area of hangar development on the airfield is due east of the Runway 13 end. Referred to as the Bravo Hangers, there are two completed buildings in this area which include a three-unit row hangar and an 8-unit T-hangar, with room for many more hangars in the area. Locations on the airfield are shown in **Exhibit 1-10**.



LEGEND

1 FAA Approach Surveillance Radar
5 City Hangar
6 Bismarck Aero Center Hangar 6
7 Hangar 7
10 FAA Remote Transmittal/Receiver (RTR)
12 NWS Inflation Shelter
14 Airport Rescue & Fire Fighting (ARFF)
17 Airline Terminal Building
18 Airport Maintenance SRE Building
21 Emergency Management (911 EOC)
22 Bismarck Aero Center/ND Aeronautics
23 FAA Bismarck ADO
24 Electrical Vault
27 NOAA
29 Aero Stor Condo Hangar
34 FAA ATCT Garage & Emergency Generator
37 EAT Fuel Farm
38 Executive Air Taxi
41 SRE Storage Building
42 Gas Station
43 Meisner Office Building
45 Basin Cooperative Services
46 FAA Air Traffic Control Tower
47 ND National Guard (A.A.S.F.)
48 Executive Air
49 Pay Parking Lot Exit Plaza
53 Simmers Hangar
55 ND National Guard (A.A.S.F.) Readiness Center
56 Jay Byer Partnership Hangar
57 BAC Fuel Farm
58 ND National Guard (A.A.S.F.) Wash Rack
59 ND National Guard (A.A.S.F.)
60 Airport Operations
61 Basin Electric
62 MDU Hangar

Exhibit 1-10 **Hangar & Support Facilities Map**

1.8. AIRSPACE, AIR TRAFFIC CONTROL AND APPROACH PROCEDURES

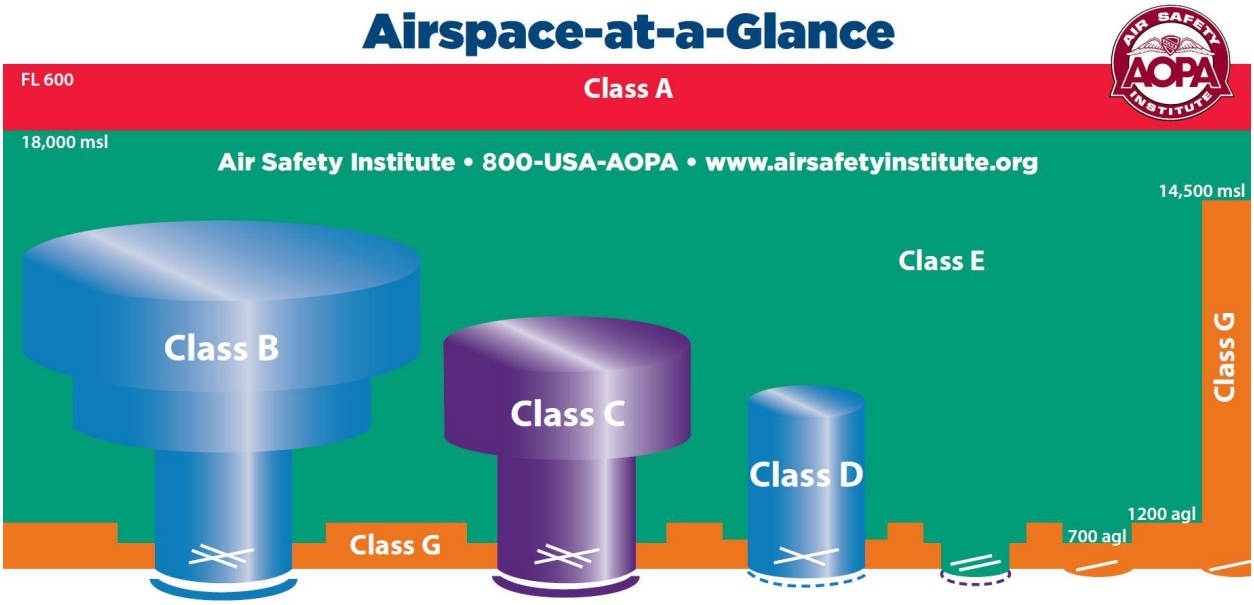
The inventory effort also reviewed how airspace is controlled around the Airport to gain a better understanding about how aircraft safely and efficiently maneuver for landing, takeoff, and taxi. This information will be beneficial for subsequent study tasks such as the demand/capacity analysis and evaluation of instrument approach procedures to help determine the air traffic control/approach procedure improvements that may be needed throughout the 20-year planning period. Information obtained as a part this task included a review of the airport traffic control tower and the existing instrument approach procedures that have been developed for the Airport. A summary of these elements for which information was obtained is presented in the following sections.

1.8.1. Airspace

In addition to facility and infrastructure information that was collected throughout the airfield, an inventory was taken of the airspace surrounding the Airport which included information on the classification of airspace as designated by the FAA. The following section provides a summary of these airspace components and lists the dimensions, where appropriate, for airspace surfaces that are associated with Runways 13-31 and 3-21.

Airspace over the United States can be classified into one of six separate categories by the FAA. The classification is based on different criteria, such as type of air traffic control (ATC) within the airspace, IFR and VFR flight requirements, and level of activity. It should be noted that there are certain operating rules, conditions, and restrictive circumstances that apply to each category of airspace. **Exhibit 1-11** illustrates the six classifications of airspace in the National Airspace System (NAS). The following text summarizes the six classifications of airspace and describes the operational criteria associated with each of them.

Exhibit 1-11: Classes of Airspace



Source: Aircraft Owners and Pilots Association (AOPA) 2016

Class A – Class A airspace is located between the altitudes of 18,000 feet and 60,000 feet MSL and lies overtop of the entire United States. Aircraft operating in Class A airspace are required to file a flight plan with an FAA Flight Service Station (FSS) do so under IFR. All aircraft operating in this airspace must receive approval from ATC before entering and must maintain constant radio communication with ATC.

Class B – Class B airspace is located between ground level and rises to 10,000 feet MSL; generally, Class B airspace is designated around airports with high levels of air traffic. The horizontal dimensions of Class B airspace can vary based on the specific needs of an airport that include orientation of the runways, surrounding land uses, and arrival and departure procedures. Aircraft operating in this class of airspace are required to receive clearance from ATC prior to entering and are required to remain in constant radio communication.

Class C – Class C airspace is from ground level to an altitude of 4,000 feet MSL and is only associated with airports that have a control tower, radar approach control, and have a large number of IFR operations. The horizontal dimensions of Class C airspace will vary depending on the specific needs of an airport but generally is designed in a two-tier shape with an inner radius of five miles around an airport from ground level to an altitude around 1,200 feet MSL while the outer radius is ten miles and ranges from an altitude of 1,200 feet MSL to 4,000 feet MSL. Permission is required from ATC for an aircraft to enter Class C airspace; constant radio communication with ATC is also required as well.

Class D – Class D airspace is located between ground level to an altitude of 2,500 feet MSL and is assigned around airports that have an air traffic control tower but may not have radar approach control. The horizontal dimensions of Class D airspace vary based upon the specific needs of an airport such as types of arriving and departing aircraft, level of IFR/VFR activity, and aircraft approach and departure routes. Aircraft operating in Class D airspace must request permission to do so from ATC and must remain in constant radio communication.

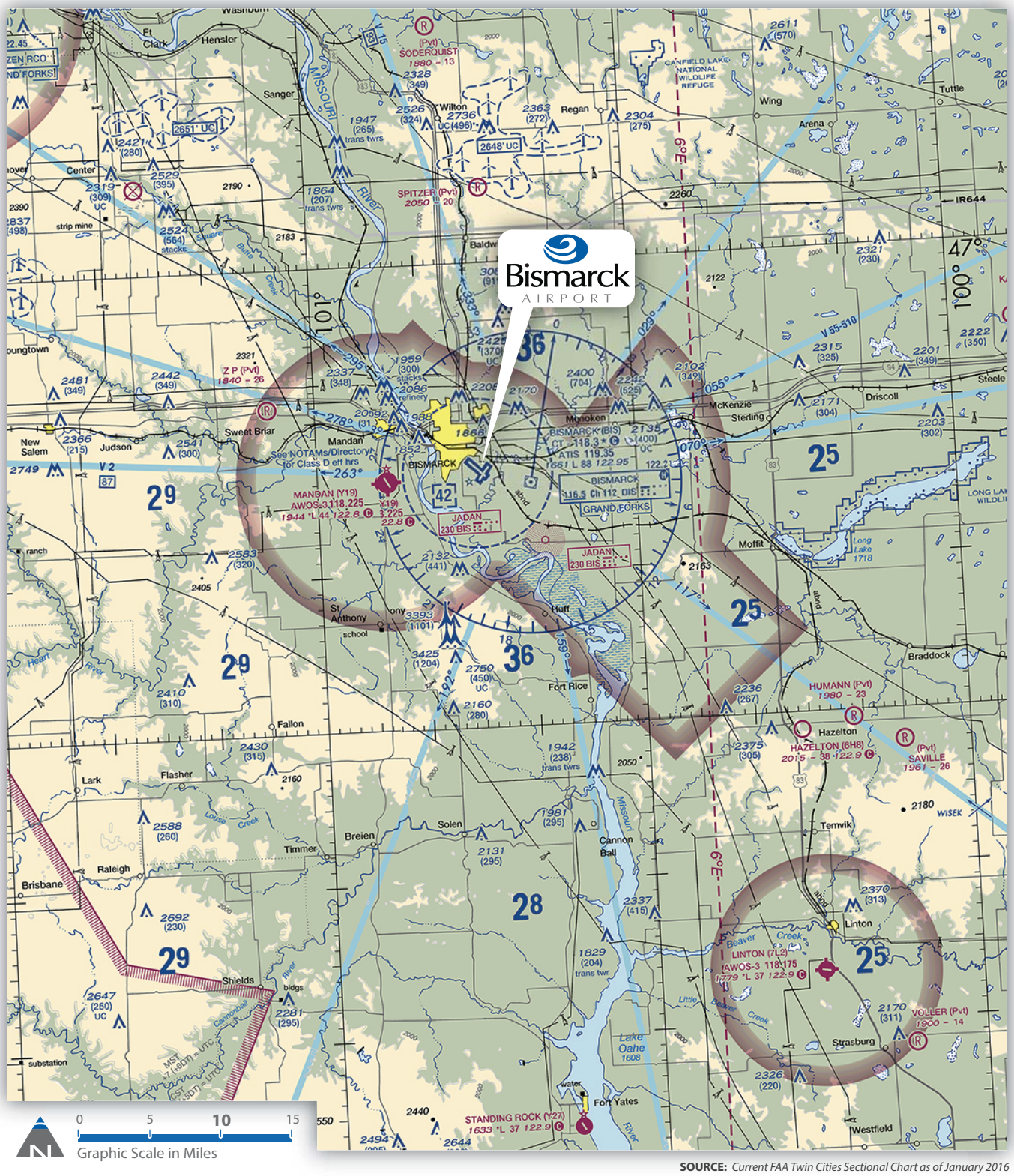
Class E – Class E Airspace is located between ground level to 18,000 feet MSL and from 60,000 feet MSL to the upper operational ceiling of aircraft that is not classified as A, B, C, D, or G. Aircraft operating under IFR are required to maintain constant communication with ATC while within Class E airspace; aircraft operating under VFR are not required to contact ATC while in Class E airspace.

Class G – While Class G airspace is classified as being located between ground level up to an altitude of 14,500 feet MSL, it is generally assigned from ground level to an altitude of 1,200 feet MSL. This class of airspace is typically found around large, remote areas and does not require aircraft operating within it to contact ATC.

As shown on the following page, **Exhibit 1-12**, Bismarck's Class D airspace is centered over the Airport and extends 4.0 nautical miles (nm) around the facility from ground level to an altitude of 18,000 feet MSL. Beyond the 4nm ring, Class E airspace, down to 700 feet AGL, extends outward from the center of the Class D; from an additional 4nm in the north to as far as 45nm to the southeast. Below this Class E layer, rests Class G airspace from the surface to 700 feet AGL.

1.8.2. Air Traffic Control

The Class D airspace around the Bismarck airport is controlled by an FAA ATCT from 1200Z – 0600Z (6:00am to 12:00am), located on the west side of the field. Aircraft separation, during those times, is the responsibility of ATC. After the tower is closed, the airfield switches to Class E, and aircraft separation is accomplished through radio contact on the CTAF frequency (118.30) and visual avoidance. Arrival and Departure radar control is provided by Minneapolis Center on 135.25 for instrument flight rules and visual flight rules as requested during the same hours. Outside of those hours, it is the responsibility of air traffic controllers from Minneapolis Center at KMSP. All aircraft, vehicles, and personnel moving on the ground are required to be in constant radio contact with BIS Ground Control while operating within the movement area on frequency 121.90 megahertz (MHz) when the ATCT is open. Ground service and fuel requests are via the UNICOM frequency at 122.95.



SOURCE: *Current FAA Twin Cities Sectional Chart as of January 2016*

Exhibit 1-12 **Sectional Aeronautical Chart**

1.8.3. FAR Part 77

The FAA established FAR Part 77 to protect aircraft operating in proximity to an airport from obstructions such as towers, buildings, and other tall objects through a set of defined surfaces centered on a runway's centerline. Through FAR Part 77, five surfaces are defined to protect aircraft arriving to, departing from, and maneuvering in the vicinity of an airport from obstructions and vary in dimension based on criteria such as type of runway, type of approach to the runway, and visibility minimums. The following section describes these surfaces and lists the dimensions for each as they are associated to the Airport's runways.

Primary Surface – The primary surface is centered longitudinally on the runway centerline at the same elevation as the runway and extends 200 feet beyond each end of a paved runway while the length is the same length as the runway for those that have turf surfaces.

The width of a primary surface runway is:

- 250 feet for utility runways (designed for propeller driven aircraft of 12,500 pounds maximum gross weight or less) having only visual approaches
- 500 feet for utility runways having non-precision instrument approaches
- 500 feet for runways other than utility having only visual approaches
- 500 feet for non-precision instrument runways other than utility having visibility minimums greater than 3/4 statue mile
- 1,000 feet for non-precision instrument runways other than utility having a non-precision instrument approach with visibility minimums as low as 3/4 statue mile
- 1,000 feet for precision instrument approach runways other than utility

The primary surface for Runway 13-31 is 1,000 feet in width since the breadth of a primary surface, as per Part 77, is to be that of the most precise approach found on either end of a runway. The total length of the Runway 13-31's primary surface is 9,194 feet since the

surface extends 200 feet beyond each end of the runway; the primary surface for 3-21 is 7,000 feet long and 500 feet wide.

Approach Surface – The approach surface is centered on the runway centerline and extends longitudinally upward and outward away from the primary surface at each end of a runway. The inner width of the approach surface is the same width as the primary surface and expands uniformly to a width of:

- 1,250 feet for the end of a utility runway with only visual approaches
- 1,500 feet for the end of a runway other than utility with only visual approaches
- 2,000 feet for the end of a utility runway with a non-precision instrument approach
- 3,500 feet for the end of a non-precision instrument runway other than utility having visibility minimums greater than 3/4 statue mile
- 4,000 feet for the end of a non-precision instrument runway other than utility having a non-precision instrument approach with visibility minimums as low as 3/4 statue mile
- 16,000 feet for precision instrument runways

The horizontal distance and slope of the approach surface is:

- 5,000 feet at a slope of 20:1 for all utility and visual runways
- 10,000 feet at a slope of 34:1 for all non-precision instrument runways other than utility
- 10,000 feet at a slope of 50:1 with an additional 40,000 feet at a slope of 40:1 for all precision instrument runways

The dimensions of the approach surfaces for Bismarck's runways are presented below in **Table 1-6**.

Table 1-6 Runway Approach Surface Dimensions		
Dimension	**Runway 13/31**	**Runway 3/21**
Inner Width	1,000 feet	1,000 feet
Outer Width	16,000 feet	4,000 feet
Slope/Horizontal Distance	50:1 for 10,000 feet; then 40:1 for an additional 40,000 feet	34:1 for 10,000 feet

Transitional Surface – The transitional surface is centered on the runway centerline and extends outward and upward perpendicularly from the width of the primary surface at a slope of 7:1 until a height of 150 feet above an airport where it intersects with the horizontal surface. The dimensions of this surface are the same for all runways, regardless of type of runway, approach, or visibility minimums.

Horizontal Surface – The horizontal surface is a horizontal plane located 150 feet above an airport and intersects with the transitional and conical surfaces. The perimeter of the horizontal surface is formed by lines of tangent from arcs generated from each runway end. The radii of the arcs are:

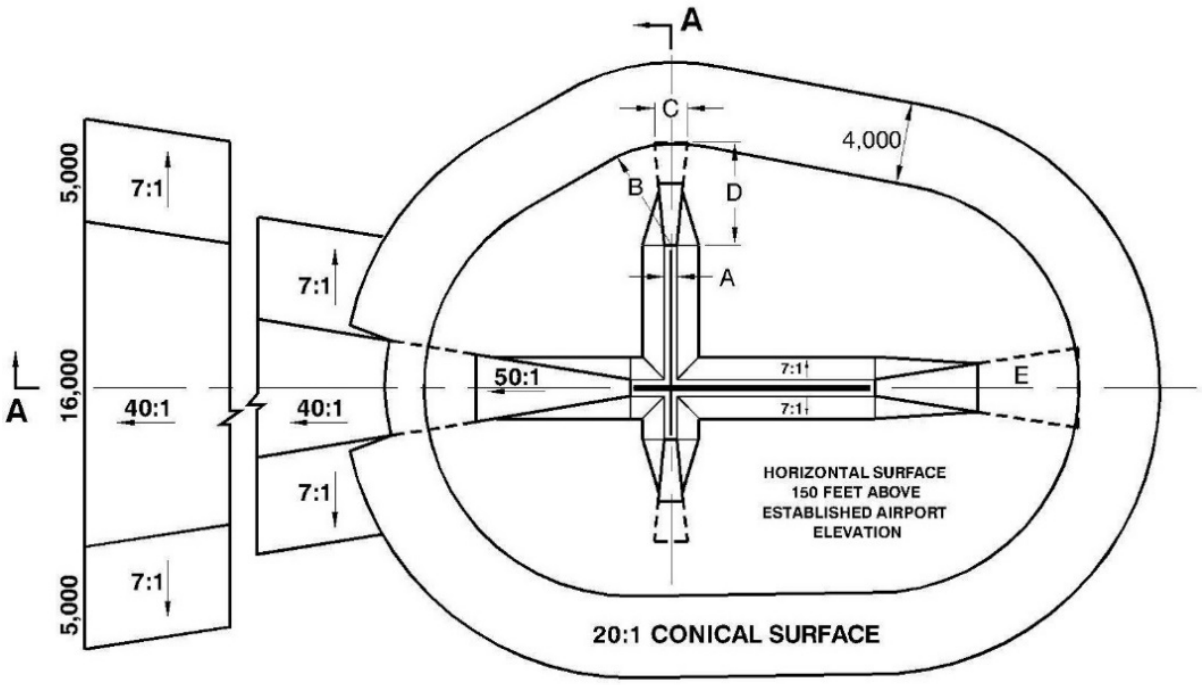
- 5,000 feet for all runways designated as utility and visual
- 10,000 feet for all other runways

The radii of the arcs used in the establishing the perimeter of the horizontal surface is 10,000 feet for Runway 13-31 and 10,000 feet for Runway 3-21.

Conical Surface – The conical surface extends outward and upward from the perimeter of the horizontal surface at a slope of 20:1 for a horizontal distance of 4,000 feet. The dimensions of this surface are also the same for all runways, regardless of type of runway, approach, or visibility minimums.

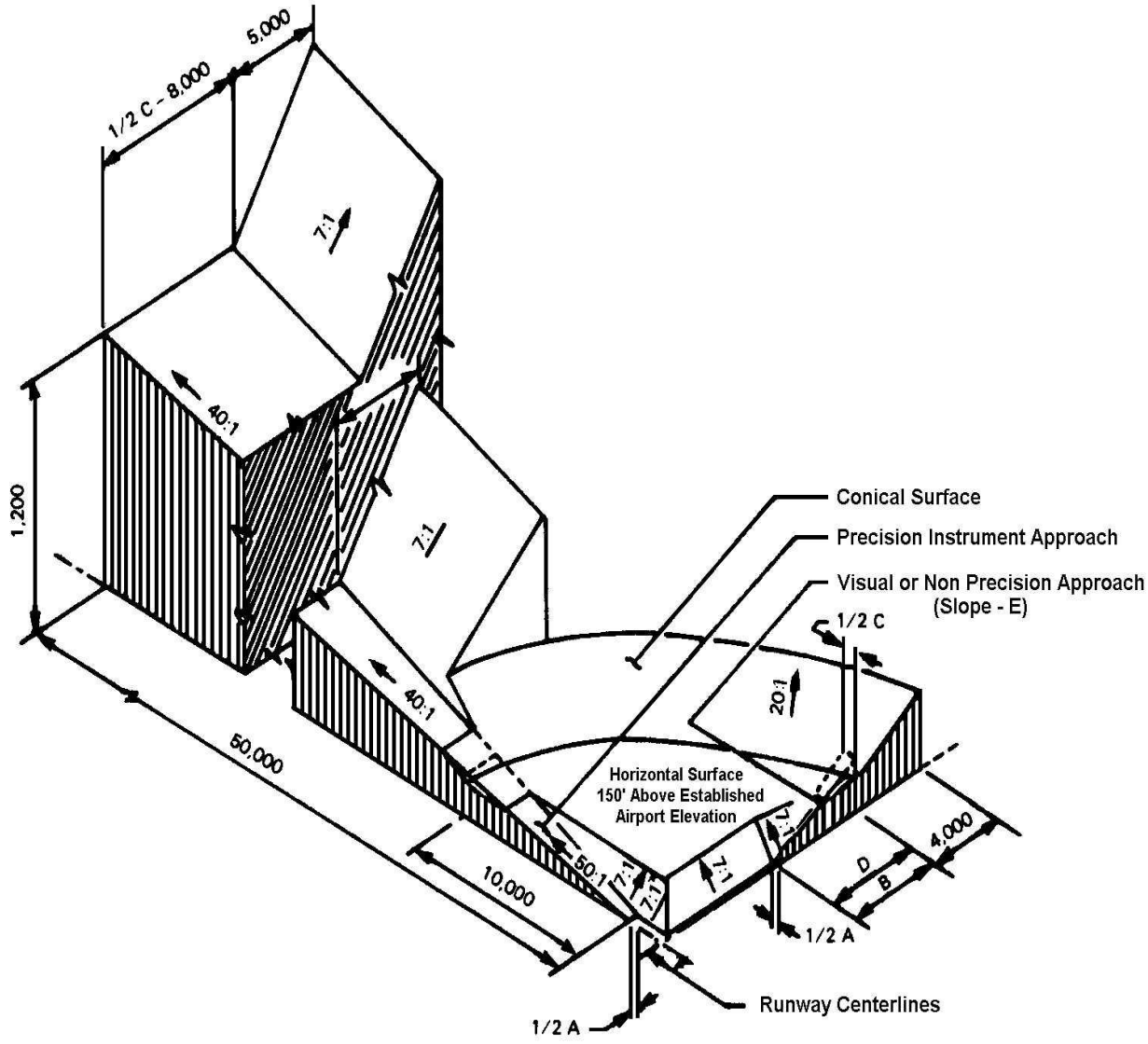
Exhibit 1-13 illustrates a plan view of the five FAR Part 77 surfaces while an isometric view is presented in **Exhibit 1-14**.

Exhibit 1-13: FAR Part 77 Surfaces – Plan View



Source: FAR Part 77

Exhibit 1-14: FAR Part 77 Surfaces – Isometric View



Source: FAR Part 77

1.8.4. Approach Procedures

Approach procedures provide pilots with a set of predetermined maneuvering instructions to successfully navigate a landing which are beneficial during conditions when visibility is limited such when low cloud ceilings are present or when inclement weather is present.

Approach procedures are also developed to help manage the flow of traffic in high volume areas as well as in situations when the flow of traffic needs to be controlled away from populated areas or for noise abatement purposes. Developed and published by the FAA, approach procedures are based on the type of navigational equipment installed on a runway. Precision instrument approaches offering the ability for pilots in properly equipped aircraft to conduct landings when low cloud ceiling heights and/or reduced visibility minimums are present are established for runways that are equipped with an ILS. Runways equipped with other NAVAID systems or with the capability to utilize GPS are assigned non-precision instrument approaches while runways that require a pilot be in constant visual contact of the airfield while on approach are assigned visual approaches. At the Bismarck Airport, seven approach procedures have been developed for arriving aircraft which are summarized below in **Table 1-7**. Full FAA approach plates, as of January 2016, can be found in Appendix B of this document.

Table 1-7 Airport Approach Minimums

Approach	Runway	Visibility	Min Altitude
ILS	13	3/4 mile	200' AGL
ILS	31	1/2 mile/2400RVR	200' AGL
RNAV/GPS	3	3/4 mile	200' AGL
RNAV/GPS	13	3/4 mile	200' AGL
RNAV/GPS	21	3/4 mile	250' AGL
RNAV/GPS	31	1/2 mile/2400RVR	200' AGL
VOR Circling	All	1 mile	579' AGL

1.8.5 Terminal Procedures (TERPS) Surfaces

TERPS surfaces exist to protect users of the airport's terminal procedures. These surfaces of varying slopes and sizes include, amongst others, the departure surface,

glideslope qualification surface, and the one engine inoperative surface. The most critical of these surfaces to be clear of instructions is the 20:1 surface that insures a minimal amount of object clearance when on final approach to the runway. The departure surface is a large 40:1 surface that allows compliance with standard departure procedures when clear. This surface is applied to all runways at airports with an instrument approach procedure and consequently, applies to all runways at the Bismarck Airport.

1.9 SUMMARY

Information obtained during the inventory effort provides a baseline to evaluate how well existing facilities are capable of accommodating future demand. Through this evaluation, an understanding can be gained of the infrastructure improvements that will be needed for the Airport to meet the air transportation requirements of central North Dakota for the next 20 years. Completion of other study tasks such as the demand/capacity analysis, evaluation of alternatives, and the development of sustainability planning initiatives are also dependent upon information obtained through the inventory effort. With a history that spans nearly 90 years, the Airport has continually evolved to meet the demands of its users. This master plan will serve as a guide to help the Airport plan for future infrastructure development as well as strengthen its commitment to be a community-friendly business and vital transportation hub for the region.

MASTER PLAN
UPDATE

Bismarck
AIRPORT

2 Aviation Activity Forecasts

2.0 AVIATION ACTIVITY FORECASTS

Forecasts of aviation demand are used to guide identification of future facility needs. In planning for the future growth of any airport, it is important to understand the context within which potential increases in aviation activity are likely to occur. Aviation forecasting is not an "exact science," so experienced aviation judgment and practical considerations will influence the level of detail and effort required to establish reasonable forecasts and subsequent airport development decisions.

This chapter includes forecasts of the following aviation activities: scheduled passenger enplanements, peak passenger activity, aircraft operations and fleet mix, based aircraft, and air cargo volumes. In addition to the development of forecasts, this chapter includes the identification of a critical aircraft. The forecast covers a 20-year period from 2015 (base year) to 2035, and the forecast elements include data at five-year intervals (2020, 2025, 2030, and 2035).

Emerging technologies should also be considered when developing an aviation forecast. For example, unmanned aerial vehicles (UAVs), sometimes called unmanned aerial systems, have begun operating at designated locations within the US. Although the Federal Aviation Administration (FAA) has begun developing regulations to govern where and how UAVs may be flown, they are not yet routinely considered in airport development planning. The FAA does not require that UAVs be included in airport forecasts. Indeed, civilian UAVs weigh too little to be counted as "aircraft" under current FAA guidance. UAV-related facilities are not currently eligible for FAA grant funds. Undoubtedly there will be changes to how UAVs are addressed in airport planning, but it is too early in the evolution of the technology to anticipate what the changes will be.

Bismarck Airport has the potential to be used in the future by both civilian and military UAVs. While the majority of the airport is devoted to civilian uses, the existence of the Army National Guard base opens the potential that military UAVs could be stationed on the airport. However, there are currently no indications that Bismarck Airport will be used by either civilian or military UAVs. Given this uncertainty and the previously mentioned lack of any FAA requirements, no forecast of UAVs is included in this chapter. This topic should be revisited when this Master Plan is updated.

Several indicators of aviation activity including regional and local trends for both commercial and general aviation were used to develop an aviation activity forecast for Bismarck Airport. These trends provide a basis for the projections of aviation activity developed for the Airport. One of the key trends examined for the development of this forecast was the effect a new oil exploration boom within North Dakota would have on aviation activity levels. Section 2.4 includes a detailed discussion on the anticipated timing of an oil boom return.

The aviation forecasts must be approved by the FAA to justify future FAA funding participation in eligible airport improvement projects. The FAA initially reviews forecasts to determine if the forecast is consistent with the 2015 Terminal Area Forecast (TAF). Forecasts of total passenger enplanements, based aircraft, and total operations are considered consistent with the TAF if they are within the following tolerances:

- Forecasts differ by less than 10 percent in the five-year forecast period.
- Forecasts differ by less than 15 percent in the 10-year forecast period.

If the forecast is not consistent with the TAF, then the document will undergo more detailed FAA review at the regional and national level. The FAA may request additional information prior to approval of the forecasts. The approved Master Plan forecasts will be used to update the TAF in the coming years.

This chapter is organized into the following sections.

2.1 Airport Role
2.2 Industry Trends
2.3 Forecasting Methodologies
2.4 General Approach to Forecasting
2.5 Passenger Enplanements
2.6 Based Aircraft
2.7 Aircraft Operations
2.8 Air Cargo
2.9 Peak Passenger Activity
2.10 Design Aircraft
2.11 Summary

2.1 AIRPORT ROLE

An airport's role is defined by the mix of aviation uses that exist, or are anticipated to exist, at the facility. Each use is defined by the type of aircraft involved and its mission. Aircraft can be used for multiple missions, such as a medium-sized turboprop that may be used by a commuter airline for scheduled passenger service, an air charter operator for on-demand air taxi service, an air cargo airline for transporting express packages, and the military for transport. It is critical to know both the aircraft type and mission in order to identify the necessary airport support facilities. A key part of the forecasting effort is to identify how the current mix of aircraft types and missions will evolve over the 20-year forecast period. This information will be used to identify needed modifications to the airfield and airport facilities.

2.1.1 Current Role

Bismarck Airport is classified as a primary, non-hub commercial airport that provides scheduled passenger service to the Bismarck metropolitan area and central North

Dakota. As of January 2016, the Airport is served by five airlines with non-stop service to seven destinations. Currently, the Airport supports the following activities:

- Passenger service
- Recreational aviation
- Business aviation
- Air cargo
- Air ambulance service
- Flight training
- Aircraft maintenance
- Military aviation
- Army National Guard air operations

The Airport is home to two fixed-base operators (FBOs) that provide a wide variety of general aviation services, including:

- Aircraft storage facilities for the full range of general aviation aircraft, including: single- and multi-engine, piston-powered aircraft; turboprops; small- to medium-sized corporate jets; and helicopters.
- Aircraft fueling, aircraft maintenance, flight training, aircraft charter, avionics repair, crew and passenger support facilities, and aircraft interiors.

The Airport hosts both scheduled and on-demand air cargo services. Key airport tenants include the North Dakota Army National Guard, Basin Electric and the Montana-Dakota Utilities (MDU) Company, North Dakota Department of Transportation, and the North Dakota Aeronautics Commission.

These mission-related roles can also be sorted into three operational groups identifying Airport roles:

- Commercial service – scheduled passenger service
- General aviation – aviation activities other than scheduled service and military
- Military – Air Guard and transient military aircraft

Data used in these forecasts come from some sources that report data based upon the Federal Fiscal Year and some that report data based upon the calendar year. **Table 2-1** presents historical activity data for the years 2005-2014 from the FAA's 2015 Terminal Area Forecast (TAF). TAF data is reported for the Federal Fiscal Year (which runs October – September), so FAA's totals will differ from those based on a calendar year. Due to the difference in reporting periods, an evaluation may result in contrary trends when making year-to-year comparisons. For example, the TAF reported that passenger enplanements decreased from 2013 to 2014 (241,451 to 237,273). If calendar year data were used, it would show an increase in passengers from 2013 to 2014 (237,683 to 245,205). This difference was caused by a growth trend that occurred from October through December 2013. Although this difference in reporting period may affect some year-to-year comparisons, it does not significantly affect long-term forecasts.

2.1.2 Future Role

The Airport is anticipated to maintain existing roles throughout the 20-year planning period. As discussed in the sections that follow, the ways in which these roles are fulfilled may evolve over time. This evolution is based on the following assumptions.

- **Scheduled and on-demand passenger service –** Replacement of 50-seat passenger regional jets used in scheduled passenger service with those having 70-76 seats or larger. Volume of on-demand service will vary with the economy.
- **Air cargo shipping –** Potential introduction of larger turboprops; most scheduled cargo will remain with smaller turboprops.
- **Business aviation –** Increase in frequency of operations and size of aircraft during periods of rapid economic growth associated with another oil exploration boom.
- **Recreational aviation –** Static or slow decline.
- **Flight training –** Static or slow decline.
- **Aircraft maintenance –** Slow growth linked to increased business use of Airport.
- **Military aviation –** Continuation in role and mix of aircraft types.
- **Disaster response –** Continuation in role.

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Table 2-1 Historical Aviation Activity													
Fiscal Year	Enplanements			Itinerant Operations					Local Operations			Total Operations	Based Aircraft
	Air Carrier	Commuter	Total	Air Carrier	Air Taxi & Commuter	GA	Military	Total	Civil	Military	Total		
2005	109,856	62,635	172,491	2,982	10,621	22,605	2,569	38,777	12,413	1,416	13,829	52,606	111
2006	111,688	68,595	180,283	2,805	9,112	21,494	2,696	36,107	12,291	1,863	14,154	50,261	89
2007	102,195	79,064	181,259	3,018	8,942	19,896	2,930	34,786	12,430	1,837	14,267	49,053	89
2008	79,012	98,820	177,832	2,745	9,418	20,495	2,961	35,619	10,365	1,791	12,156	47,775	86
2009	81,124	102,356	183,480	2,852	9,104	17,383	2,770	32,109	10,450	1,733	12,183	44,292	95
2010	79,287	115,814	195,101	2,525	9,247	16,936	2,129	30,837	13,261	966	14,227	45,064	78
2011	60,171	131,783	191,954	1,524	10,151	18,958	3,087	33,720	12,489	1,642	14,131	47,851	87
2012	69,889	159,534	229,423	1,774	10,169	22,114	2,361	36,418	13,352	1,240	14,592	51,010	87
2013	85,503	155,948	241,451	2,406	10,279	21,045	2,196	35,926	10,944	1,483	12,427	48,353	93
2014	83,934	153,339	237,273	2,339	10,102	24,326	1,795	38,562	14,969	825	15,794	54,356	117
CAGR '05-'14	**-3%**	**10%**	**4%**	**-3%**	**-1%**	**1%**	**-4%**	**0%**	**2%**	**-6%**	**1%**	**0%**	**1%**
CAGR '09-'14	**1%**	**8%**	**5%**	**-4%**	**2%**	**7%**	**-8%**	**4%**	**7%**	**-14%**	**5%**	**4%**	**4%**

Source: FAA 2015 Terminal Area Forecast

Note: Actual historic activity differs from calendar year verses FAA fiscal year (October – September)

Enplanements: "Air Carrier" = Legacy Carriers, "Commuter" = Regional Airlines

CAGR = Compound Average Annual Growth Rate

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2.2 INDUSTRY TRENDS

Industry trends are based upon data available through January 2016. Separate sections will discuss national trends for passenger enplanements, the general aviation fleet, aircraft operations, and air cargo. This information will provide a context for review of historical activity levels at Bismarck Airport and development of forecasts. Most forecast material is extracted from the FAA's Aerospace Forecast Fiscal Years 2015-2035 (hereafter Aerospace Forecast). The Aerospace Forecast presents FAA expectations for the aviation industry at a national level for the next 10 years and is updated annually.

2.2.1 Passenger Enplanements

The TAF divides the passenger airline industry into two categories of airlines: air carrier and air taxi/commuter (also called "regional" airlines). The primary difference between the two is the role that the airline plays relative to the other. Regional airlines carry passengers to the hub cities of the air carrier airlines and may feed passengers onto air carrier service at the hub cities. Regional airlines may operate aircraft painted like air carrier airlines and may have their tickets sold by the air carrier operator. Air carrier airlines typically fly aircraft with more passenger seats than regional airlines and serve larger markets. However, the difference between air carrier and regional airlines is generally indistinguishable to a passenger with the exception of aircraft size.

The foremost challenges facing the airline industry today with regard to passenger enplanements are the volatility of fuel prices and uncertainty over the strength of the global economy. Nationally, passenger enplanements have returned to levels achieved prior to the recession that began in 2008. Economic recovery, airline consolidation, and capacity constraints have restored airline profitability. Airlines have increased load factors, the percentage of occupied seats occupied, by reducing flight frequencies. This practice has reduced consumer choice, effectively consolidating a growing number of passengers on to fewer flights. Airlines are also adding aircraft with more seats, which

has further necessitated the need to cut frequencies in order to operate the flight profitably.

The Aerospace Forecast projects that national passenger enplanements (domestic plus international) will increase an average of 1.9 percent per year through 2035. Air carrier airlines, called “mainline carriers” in the Aerospace Forecast, are expected to grow at 2 percent a year. This is higher than regional airlines, which are projected to grow at 1.6 percent a year. This section of the Aerospace Forecast is summarized in **Table 2-2**.

As a result, commercial carrier capacity is expected to grow at a slightly slower rate than enplanements, airliners will remain crowded. Domestic commercial carrier capacity (i.e., total number of passenger seats) is expected to grow slowly at an average of 1.8 percent per year, with mainline carriers growing slower than regional carriers, 1.8 percent versus 2.0 percent.

Table 2-2 Comparison of Forecast Passenger Enplanement Growth Rates

Carriers	Domestic + International Flights 2016-2035	Domestic Flights		
		2016-2025	2026-2035	2016-2035
Mainline Carriers	2.0%	1.5%	1.8%	1.7%
Regional Carriers	1.6%	1.5%	1.8%	1.7%
All Carriers	1.9%	1.5%	1.8%	1.7%

Source: FAA Aerospace Forecast Fiscal Years 2015-2035

2.2.2 General Aviation Aircraft Fleet

The total number of aircraft in a given area or organization is referred to as a fleet. The Aerospace Forecast indicates that the national general aviation fleet decreased by 10.5 percent from 2010 to 2013. This decline is partially due to aging aircraft requiring expensive repairs to remain airworthy. Other contributing factors are the aging pilot

community struggling to meet medical requirements, the rising cost associated with aircraft ownership, and fewer new pilots overall. Fewer pilots results in reduced demand for new aircraft, particularly those purchased by individuals who would fly for recreation. The Aerospace Forecast expects the number of private pilots in the U.S. to decrease at 0.35 percent per year through 2035.

The Aerospace Forecast projects that the number of piston fixed wing aircraft will continue to decline through 2035. Multi-engine piston aircraft are projected to decline by 0.4 percent per year and single-engine aircraft are forecast to decline at a rate of 0.6 percent per year. However, within the single-engine group, the light sport aircraft segment is forecast to experience 4.3 percent annual growth, although this user class makes up less than 2 percent of the national fleet.

Although the general trend has been one of decline, there are areas of growth for certain segments of the national fleet. Continued concerns about safety, security, and flight delays keep business aviation attractive relative to commercial air travel. For these reasons, the turbine aircraft fleet (jets, turboprops and turbine-powered helicopters) is forecast to grow from 14.3 percent of the general aviation fleet to 21.5 percent by 2035. **Table 2-3** shows that it is the growth of turbine aircraft that supports the projection that the total general aviation fleet will grow at an average annual rate of 0.4 percent through 2035.

Table 2-3 Comparison of Forecast Growth Rates by Aircraft Type								
Year	Total Fleet	Rotorcraft	Fixed Wing					
			Turbine	Multi-Engine Piston	Single-Engine Piston	Light Sport	Experimental	Other
2015*	198,780	10,440	21,305	13,175	122,435	2,355	24,880	4,190
2035	214,260	17,110	33,785	12,135	108,810	5,360	33.040	4,020
CAGR	0.4%	2.5%	2.2%	-0.4%	-0.6%	4.3%	1.4%	-0.2%

Source: FAA Aerospace Forecast Fiscal Years 2015-2035
*Estimate from Aerospace Forecast
CAGR = Compound Annual Growth Rate

2.2.3 Aircraft Operations

The number of annual aircraft operations at towered airports in the United States has declined steadily from 2001-2015 (from 66.2 million to 49.6 million). The sharpest drop in all segments of the aviation industry occurred in 2009, the year following the beginning of the recession. From 2013 to 2014, the number of operations by commercial aircraft (air carrier and regional) grew, reflecting improvement in the national economy. Unlike passenger enplanements, which are categorized as air carrier or regional based on the airline's role, operations are categorized based on aircraft seating capacity. Aircraft with 60 or more seats are air carrier, and aircraft with fewer than 60 seats that are operated by airlines are air taxi/commuter.

Nationally, general aviation operations overall grew from 2011 to 2012, before declining again in subsequent years. Segments of the general aviation market, namely aircraft used for business purposes, are operating more frequently, while flight training and leisure and hobby flying are contracting. Business general aviation is growing in response to airline consolidation – it is simply less convenient to fly commercially than it used to be. Flight training is growing among students interested in the airline career track, but fewer are

learning to fly as a hobby. This has led to the decline in leisure pilots. Reasons for this decline includes the increased cost of aircraft ownership, the expense associated with learning to fly, and competing financial needs. Younger generations are saving for a home and repaying student loans, which limits discretionary income.

The Aerospace Forecast projects total operations by all segments of the aviation industry to increase at an average rate of 0.9 percent per year through 2035 at towered airports. Most of the growth is expected to be from increased commercial aircraft activity (up 1.5 percent annually). The air carrier component is projected to increase an average of 2.7 percent per year. Nationally, the increase in air carrier activity is expected to occur due to a combination of air carrier airlines increasing frequencies on select routes, and a switch by regional airlines from 50 seat aircraft to 70-90 seat aircraft. In some instances, regional airlines are replacing 50-seat aircraft with larger regional jets having more than 100-seats without increasing frequency. Air taxi/commuter operations are forecast to fall 4.9 percent in 2015 and decrease 1 percent per year through 2035. This reduction in the air taxi/commuter component will be driven by the retirement of passenger jets with fewer than 50 seats. At small- and non-hub airports such as Bismarck Airport, the FAA's FY 2015-2035 Aerospace Forecast projects total operations to increase at an average annual rate of 0.5 percent a year. The Aerospace Forecast projects that general aviation activity at towered airports will increase an average of 0.3 percent annually through 2035.

2.2.4 Air Cargo Volumes

The Aerospace Forecast concludes that the national volume of air cargo follows trends in the gross domestic product, with secondary influences of airline fuel costs and the need for just-in-time logistics chains. Air cargo volumes have grown since the post-recession low point in 2009, although there has been some year-to-year variability. The significant structural changes in the air cargo industry that have occurred over the last decade have affected air cargo volumes, including: FAA and TSA air cargo screening requirements,

maturation of the domestic express package market, a shift from air to other transportation modes (especially truck), use of all-cargo carriers by the U.S. Postal Service, and the increased use of internet-based mail substitutes. The shift from air to other modes may be a temporary cost-cutting measure linked to the recession. If so, improvements in the economy will result in a shift back to air cargo. However, commenters with the Air Cargo News also suggest factors that work against a return to use of air cargo. These include: companies better managing their supply chains are able to reduce their use of expedited shipping; electronic devices have become smaller and lighter; and shifts from use of freight haulers to cargo integrators (such as FedEx and UPS). Another key change is the continuing reduction in the amount of air cargo carried on passenger airliners.

The Aerospace Forecast projects that air cargo volumes will increase at an average annual rate of 0.5 percent. The all-cargo carriers' share of the air cargo market is forecast to grow from 89.2 percent to 90.2 percent by 2035 as passenger airlines take less and less cargo.

2.3 FORECASTING METHODOLOGIES

A number of forecasting techniques may be used to project aviation activity. They range from subjective judgment to sophisticated mathematical modeling. These forecasts utilize local and national industry trends in assessing current and future demand. Socioeconomic factors such as local population, retail sales, employment, and per capita income have also been analyzed for the effect they may have had historically and may have on future levels of activity. The comparison of the relationships among these various indicators provided the initial step in the development of realistic forecasts for future aviation demand.

Sixty-four local and national aviation and socioeconomic factors were evaluated for correlations with the airport performance measures being forecast in this Chapter. **Table 2-4** presents those factors with the highest correlations with six airport performance measures. This information will be used to select the most appropriate methodologies for forecasting the airport performance measures. **Table 2-5** lists the data sources used to produce the correlations in Table 2-4.

In the tables and text that follow the statistical measure r is used to measure the strength of the relationship between two factors. An r can range from -1.00 (one variable increases, the other decreases proportionally) to +1.00 (both variables grow or decline proportionally at the same time). A score close to +/-1.00 suggests a stronger correlation, and a score closer to zero suggests that the two variables are not correlated. Typically, an r of at least +/-0.70 is needed to conclude that there is a substantial correlation between the two factors. It is important to understand that correlation does not necessarily imply causality. It could be possible that the two factors are jointly being influenced by another factor.

Those factors with the highest correlations for each activity are shown below. Some factors for which one would logically expect high correlations did not prove to have them. For example, local civil operations and based aircraft turned out to have low correlations with local population (r = 0.56 and 0.56) and personal income (r= 0.65 and 0.62).

Methodologies used to develop forecasts described in this section include time-series methodologies and socioeconomic methodologies. Another common methodology, market-share projection, has not been used in forecasting. The market share methodology compares local levels of activity with those of a larger market (e.g. state, nation, or world). Such methodologies imply that the proportion of activity that can be assigned to the local level is a fixed percentage of the larger entity.

Table 2-4 Bismarck Airport Activity Correlation Analysis						
Rank	**Enplanements**		**Air Carrier Ops.**		**Air Taxi Ops.**	
	Factor	***r***	**Factor**	***r***	**Factor**	***r***
1	Personal Income	0.97	AC Enplanements	0.77	Total Retail Sales	0.93
2	GRP	0.97	National AC Ops.	0.53	Total Personal Income	0.93
3	Population	0.97	Nat'l Mainline Enplanements	0.43	Total Earnings	0.92
4	Total Earnings	0.96	Nat'l Mainline + Reg'l Enplanements	0.36	Population	0.91
5	Mining Earnings	0.96	National ATP Pilots	0.07	National ATP Pilots	0.69
Rank	**Itinerant GA Ops.**		**Local GA Ops.**		**Based Aircraft**	
	Factor	***r***	**Factor**	***r***	**Factor**	***r***
1	Based Aircraft	0.79	National Student Pilots	0.64	National ATP Pilots	0.86
2	National ATP Pilots	0.79	Total Retail Sales	0.61	Total Retail Sales	0.72
3	Total Retail Sales	0.69	Mining Earnings	0.60	Total Employment	0.72
4	Total Employment	0.64	Total Earnings	0.59	Total Earnings	0.66
5	Mining Earnings	0.61	Total Personal Income	0.56	Population	0.65

GA = General Aviation; GDP = Gross Domestic Product; GRP = Gross Regional Product; Ops = Operations; Nat'l = National AC = Air Carrier; Reg'l = Regional; Data sources are shown in Table 2-5.

The market share method has been used extensively in the aviation industry to develop forecasts at the local level. Historical data is most commonly used to determine the share of total national traffic activity that will be captured by a particular region or airport. This share is then applied to forecasts of activity for the larger entity. However, as shown in Table 2-4, activity metrics at Bismarck Airport do not correlate well with national aviation trends. Therefore, the market share methodology was not used to prepare forecasts.

Table 2-5 Bismarck Airport Activity Correlation Analysis Data Sources		
Factor	**Type(Scale)**	**Source**
Population	Socioeconomic (Local)	Woods & Poole
Gross Regional Product		
Mining Earnings		
Personal Income		
Total Earnings		
Total Employment		
Total Personal Income		
Total Retail Sales		
National Air Carrier Operations	Aviation (National)	FAA Aerospace Forecast
National Airline Transport Pilots		
National Student Pilots		
National Mainline + Regional Enplanements		
National Mainline Enplanements		
Air Carrier Enplanements	Aviation (Local)	FAA TAF
Based Aircraft		

Source: Mead & Hunt, 2016

2.3.1 Socioeconomic Methodologies

Though trend line extrapolation and regression analyses may provide mathematical and formulaic justification for demand projections, there are many factors beyond historical levels of activity that may identify trends in aviation and its impact on local aviation demand. Socioeconomic and correlation analyses examine the direct relationship between two or more sets of historical data. Local market conditions examined in this chapter include population, total employment, total retail sales, and per capita income for the Bismarck Metropolitan Statistical Area (MSA).

The Bismarck MSA includes Burleigh, Morton, Oliver, and Sioux counties. Historical and forecasted socioeconomic statistics for this MSA were obtained from the economic forecasting firm Woods & Poole Economics. Based upon the observed and projected

correlation between historical aviation activity and the socioeconomic data sets, future aviation activity projections were developed. **Table 2-6** presents forecasts of socioeconomic indicators that are utilized in various locations of this chapter.

2.3.2 Time-Series Methodologies

Historical trend lines and regression analyses are widely used methods of forecasting. These techniques utilize time-series types of data and are most useful for a pattern of demand that demonstrates a historical relationship with time. Trend line analyses used in this chapter are linearly extrapolated, establishing a trend line using the least squares method to known historical data. Regression analyses used in this chapter were linear and used a single variable.

2.4 GENERAL APPROACH TO FORECASTING

The key challenge in this forecasting effort is how to incorporate the potential for a return of an economic boom associated with oil exploration. In considering this issue it is important to distinguish between ongoing oil production in North Dakota and an oil exploration boom. North Dakota is the second largest oil producing state after Texas. The various oil fields in North Dakota will continue to produce oil as long as the market price does not drop lower than their costs to produce the oil. In September 2015, the North Dakota Department of Mineral Resources (Mineral Resources) calculated the price at which the cost of producing oil from existing wells exceeds production costs in the oil producing counties in North Dakota. This break-even price in the three counties with the lowest production costs ranged from $24 to $27 per barrel. At the high end of the production cost range, other counties in North Dakota had break-even costs calculated at $85 per barrel.

Table 2-6 Historical and Projected Socioeconomic Indicators for Bismarck Airport										
Year	Total Population	Total Employment	Total Earnings	Mining Earnings (includes oil)	State and Local Government Earnings	Health Care and Social Assistance Earnings	Farm Earnings	Total Personal Income	Gross Regional Product	Total Retail Sales
Historical										
2000	101,020	70,185	2,408,846,000	10,855,000	419,092,000	354,530,000	63,484,000	3,107,766,000	3,590,442,000	1,607,992,000
2001	101,289	70,601	2,570,217,000	10,451,000	439,893,000	382,696,000	52,365,000	3,271,105,000	3,792,554,000	1,608,492,000
2002	102,340	71,229	2,642,454,000	14,472,000	461,316,000	440,434,000	11,086,000	3,324,641,000	4,022,472,000	1,619,463,000
2003	103,201	72,298	2,807,689,000	14,329,000	480,072,000	453,657,000	56,237,000	3,476,443,000	4,277,572,000	1,671,545,000
2004	104,211	74,380	2,925,802,000	12,780,000	493,847,000	478,360,000	55,471,000	3,650,836,000	4,389,184,000	1,748,046,000
2005	105,942	76,398	2,998,770,000	19,646,000	496,055,000	484,001,000	83,892,000	3,762,114,000	4,504,745,000	1,831,664,000
2006	107,861	78,899	3,046,752,000	18,843,000	495,307,000	497,431,000	32,674,000	3,880,277,000	4,643,086,000	1,900,796,000
2007	109,742	80,587	3,139,701,000	19,993,000	507,317,000	501,761,000	64,096,000	4,078,073,000	4,870,828,000	1,947,029,000
2008	111,282	82,181	3,181,434,000	22,466,000	531,445,000	517,362,000	51,339,000	4,189,889,000	5,041,890,000	1,877,674,000
2009	113,143	83,078	3,295,240,000	18,812,000	582,540,000	549,710,000	83,613,000	4,254,014,000	5,211,998,000	1,752,300,000
2010	115,233	83,391	3,421,615,000	32,046,000	636,926,000	581,152,000	83,029,000	4,554,092,000	5,501,272,000	1,835,839,000
2011	117,208	85,653	3,603,018,000	48,909,000	652,595,000	615,464,000	78,885,000	4,896,715,000	5,761,786,000	1,942,594,000
2012	120,085	89,299	3,965,613,000	64,323,000	658,766,000	658,673,000	163,253,000	5,341,362,000	6,438,899,000	2,041,269,000
2013	123,751	91,845	4,071,080,000	68,075,000	702,908,000	686,402,000	37,576,000	5,405,598,000	6,801,109,000	2,143,587,000
2014	125,605	93,900	4,339,490,000	66,922,000	720,172,000	738,164,000	56,525,000	5,678,155,000	7,217,614,000	2,213,501,000
2015	127,540	95,988	4,479,512,000	68,471,000	735,616,000	769,915,000	57,155,000	5,858,156,000	7,453,953,000	2,267,142,000
Projected										
2020	137,931	106,384	5,217,644,000	76,758,000	811,472,000	949,447,000	60,198,000	6,833,226,000	8,702,389,000	2,540,339,000
2025	148,947	117,276	6,048,762,000	86,017,000	884,135,000	1,168,770,000	63,052,000	7,957,122,000	10,109,448,000	2,813,233,000
2030	160,452	128,458	6,966,025,000	96,355,000	952,273,000	1,432,616,000	65,699,000	9,171,087,000	11,663,769,000	3,093,284,000
2035	172,063	139,828	7,975,968,000	107,898,000	1,015,152,000	1,741,031,000	68,126,000	10,434,018,000	13,375,100,000	3,386,664,000
CAGR(2015 -2035)	*1.51%*	*1.90%*	*2.93%*	*2.30%*	*1.62%*	*4.16%*	*0.88%*	*2.93%*	*2.97%*	*2.03%*

Note: Bismarck Metropolitan Statistical Area (MSA)
CAGR = Compound Annual Growth Rate
Dollar values are in 2009 dollars
Source: Woods & Poole Economic Inc.

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As a point of reference, the price for North Dakota sweet crude oil was $36.25 a barrel on July 15, 2016, according to the July *Director's Cut* newsletter published by Mineral Resources. Mineral Resources indicated that the number of producing oil wells in North Dakota declined for the first time in nearly 12 years, and the state saw a drop in the production of oil and natural gas. However, in spite of the low price of oil in early 2016, the production segment of the oil industry has been less affected than the exploration segment of the industry.

Mineral Resources states that the number of active oil drilling rigs has dropped from 171 in January 2015 to 58 in January 2016, suggesting that the oil exploration boom has ended. The oil exploration boom will return when the industry believes that the price of oil will remain high enough during the time it takes to put an exploratory well into production. Timing of the next oil exploration boom depends on the market price of oil.

A review of published estimates from industry sources yielded estimates of when oil prices would rise from six months to five years and beyond.

- Mineral Resources indicated an expectation that supply and demand for oil would reach a balance in late 2016, followed by an increase in oil prices in 2017.
- The PRICE Futures Group expects oil prices to rise after two years.
- The International Energy Agency Medium-Term Oil Market Report 2015 predicts that prices will stabilize at levels higher than recent lows but substantially below the highs of the last three years (2012-2015).
- Vitol Group BV, the largest oil-trading house, expects the oil price to "bounce around a band width of $50 a barrel for the next decade."

It seems plausible that oil prices could again rise to levels that would restart the recent oil exploration boom. However, the uncertainty of a new oil boom and the greater uncertainty of when it would begin are judged to be too high to be used in forecasting at the Airport. Therefore, the general approach to activity forecasts for Bismarck Airport is not to use

methodologies that would emphasize the high growth rates experienced over the last five years (2011-2015). Instead, the chosen methodologies will utilize factors tied to the longer-term growth rates experienced at Bismarck Airport.

It remains appropriate for the Airport staff to monitor changes to the oil industry in North Dakota. Comparing oil-related employment estimates prepared by the Department of Mineral Resources to changes in passenger enplanement volumes suggests that there is a two- to three-year lag between when oil jobs begin rapid increases and when passenger enplanements begin showing rapid year-over-year changes. This gives the Airport staff the lead time to begin implementation of operational and facility changes to accommodate high growth rates.

2.5 PASSENGER ENPLANEMENTS

Passenger enplanement forecasts are used to anticipate facility needs, such as expansion of the passenger terminal or modification of gates to accommodate different classes of aircraft. A passenger enplanement is defined as the act of one passenger boarding a commercial service aircraft that departs an airport. Passenger enplanements include scheduled and non-scheduled flights of more than nine passenger seats, and do not include airline crew. Total passengers is equal to enplanements and deplanements (passengers getting off an aircraft). For the purpose of the aviation forecast, deplanements are equal to enplanements. Passenger enplanement data is provided by the airport management and commercial passenger service carriers. The following sections include a description of enplanement trends and enplanement forecasts.

2.5.1 Historical Patterns

As shown in **Exhibit 2-1**, passenger enplanements at Bismarck Airport have grown from 120,589 in 1998 to 259,734 in 2015. Average annual growth rates were higher than 4 percent during the oil exploration boom years (2011-2015), compared to 1.6 percent in the pre-oil boom years. Although enplanements in 2015 were 5.9 percent higher than

2014, growth slowed during the last quarter of 2015. Enplanements were 17.3 percent higher in September 2015 than 2014, 2.5 percent higher in October, 1.5 percent lower in November, and 1.8 percent lower in December. The decline continued in 2016 with January being 0.7 percent lower than January 2015 and February being 0.2 percent lower than February 2015. The trend then reversed with 9.2 percent year-over-year growth in March 2016. The next three months (April-June) showed year-over-year growth of 4.6 percent, 4.8 percent, and 4.1 percent respectively. Passenger enplanements through the first six months of 2016 total 4.0 percent higher than for the comparable period in 2015.

In 2014-2015 North Dakota lost 7,000 oil-related jobs. Communities with less diversified economies, such as Dickinson near the Bakken Oil Fields, lost airline service. Although the economic decline related to the oil industry may slow the growth of passenger enplanements at Bismarck Airport in 2016 and beyond, it is clear that other economic sectors such as tourism and state government profoundly affect the economics of the Bismarck metropolitan area.

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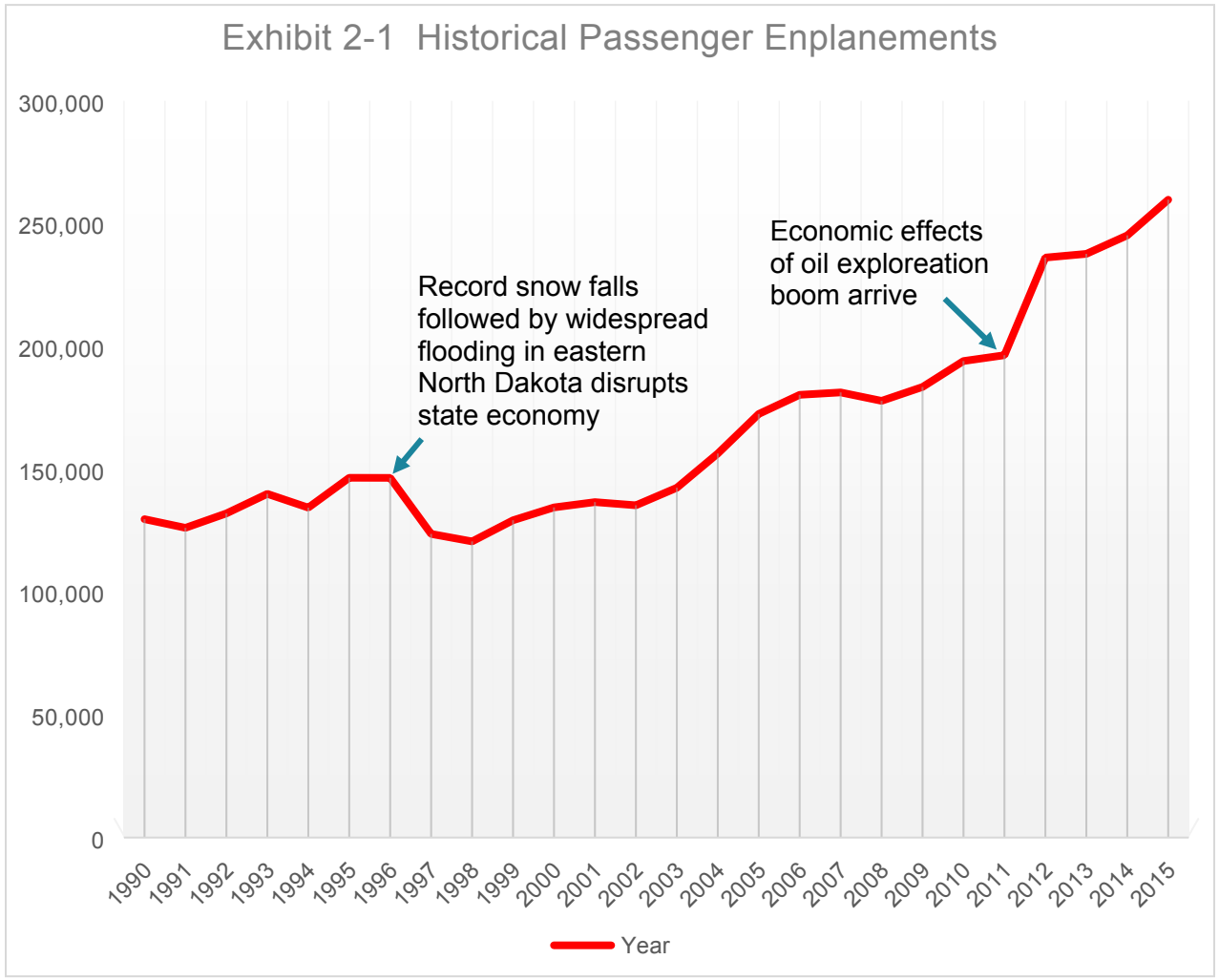

Year	Enplanements
1990	129,649
1991	126,126
1992	132,001
1993	139,955
1994	134,346
1995	146,501
1996	146,466
1997	123,639
1998	120,589
1999	129,206
2000	134,437
2001	136,597
2002	135,303
2003	142,434
2004	156,384
2005	172,491
2006	180,283
2007	181,259
2008	177,832
2009	183,480
2010	194,043
2011	196,414
2012	236,172
2013	237,683
2014	245,205
2015	259,734
CAGR (1990-2015)	**2.8%**
CAGR (2000-2015)	**4.5%**

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2.5.2 Forecasts

Passenger Demand Analysis

In order to understand the travel habits of Bismarck Airport passengers, the forecast effort includes a Passenger Demand Analysis. The results of this analysis are summarized in this section. The report provides an understanding of the Bismarck Airport air travel market and includes the following sections.

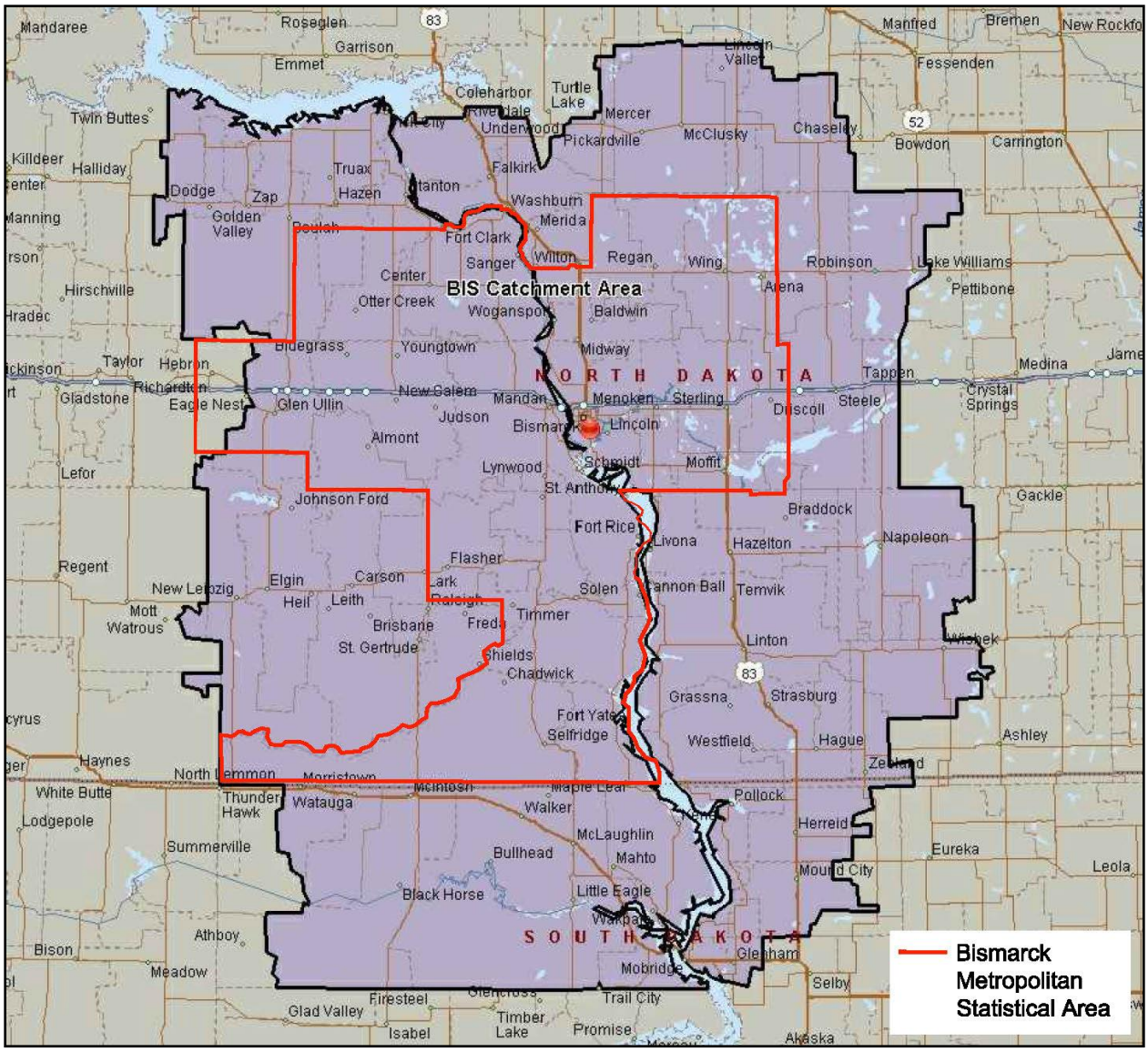
- The originating airports used by air travelers in the airport's catchment area
- Diversion of airline passenger traffic to competing airports
- An estimate of total airline passengers in the catchment area and destinations
- Airlines used by local air travelers
- Average airfares by origin and destination airport
- Service levels at Bismarck Airport and competing airports

The Passenger Demand Analysis utilizes Airline Reporting Corporation (ARC) ticketed data and US Department of Transportation (DOT) airline data to provide a comprehensive overview of the air travel market. A total of 14,090 ARC tickets for the year ended June 30, 2015, were used in this analysis.

The analysis began by defining an airport catchment area for Bismarck Airport. An airport catchment area, or service area, is a geographic area surrounding an airport where it can reasonably expect to draw passenger traffic and is representative of the local market. The catchment area contains the population of travelers who should use Bismarck Airport considering the drive time from the catchment area to competing airports. This population of travelers is Bismarck Airport's focus market for air service improvements and represents the majority of travelers using the local airport. **Exhibit 2-2** shows the catchment area defined for Bismarck Airport. Some of the socioeconomic data used in this analysis is taken from sources that use the Bismarck MSA. As can be seen in Exhibit

2-2, the Bismarck MSA encompasses a smaller geographic area than the Catchment Area. Both the MSA and catchment area include the core cities of Bismarck and Mandan.

Exhibit 2-2 Bismarck Catchment Area



The Passenger Demand Analysis found the following information.

- The Bismarck Airport catchment area has a population of 154,260 in sixty-four zip codes.
- The airport's true market is estimated at 547,976 annual origin and destination passengers (see **Table 2-7**). An airport's true market is 100% of all passengers that arrive at or depart from an airport's service area. A true market includes those passengers who use an alternate airport. For example, Bismarck's true market include passengers who live in Bismarck but chose to drive to Minot for a particular flight.
- Domestic travelers accounted for 516,465 of the total true market (94 percent). International travelers made up the remaining 31,511 passengers (6 percent).
- 93 percent of catchment area travelers used Bismarck Airport, while 6 percent diverted to Fargo's Hector International Airport (FAR), and 1 percent to Minot International Airport (MOT). 93 percent of domestic travelers and 94 percent of international travelers used Bismarck Airport.
- 66 percent of travelers, or 358,981 passengers, were destined to or from one of the top 25 markets. Las Vegas was the number one destination with 11 percent of passengers. Bismarck Airport retained 98 percent of passengers to Las Vegas. The next largest markets were Denver, Phoenix-Mesa, Orlando-Sanford, and Minneapolis. Bismarck Airport had service to all of its top six markets, with a mixture of leisure (Allegiant) and legacy airlines (American, Delta and United).
- Bismarck Airport is in an isolated area in the center of North Dakota. With the nearest competing airport (one with comparable service) nearly three hours away, diversion to an alternate airport is not a major issue for Bismarck Airport.
- Much of the growth in the state of North Dakota can be attributed to the growth in the oil and gas industry. As the state economy grew at a very fast pace, the air service at BIS grew more rapidly than similar sized markets in

the rest of the U.S. It is expected that service levels and demand at BIS will continue to be influenced by the health of the oil and gas industry in North Dakota. Oil prices plummeted in 2015 and have remained low in 2016 (through July 2016). It is anticipated that the demand for air service will slow to rates below the oil boom peak growth rates. Peak oil boom year-over-year growth rates were as high as 20.2 percent from 2011-2013 and 5.9 percent from 2014-2015.

- Opportunities for more capacity will likely be in the form of larger gauge aircraft as the legacy airlines replace 50-seat regional jets with larger regional jets and smaller mainline aircraft. There is the potential for Allegiant to add service to Tampa-St. Petersburg. The stage length would be comparable to that to Orlando which already has service from Bismarck.

General Approach to Forecasting Enplanements

Enplanement forecasts emphasize methodologies that are independent of the recent 2011-2015 growth rates associated with the oil exploration boom. Therefore, passenger enplanement forecasts look to historical trends, correlated growth indices, and FAA projections to project enplanement levels at Bismarck Airport.

It is noted in Table 2-4 that a correlation analysis compared sixty-four aviation-related and socioeconomic factors to historical aviation activity at Bismarck Airport. Although strong correlation between two variables is not sufficient to determine causation on its own, it can be helpful in investigating what is driving enplanement growth. The four strongest correlations for passenger enplanements were:

- Total personal income within the Bismarck MSA – r = 0.97
- Gross Regional Product – r = 0.97
- Total MSA population – r = 0.97
- Mining earnings within the Bismarck MSA – r = 0.96

Table 2-7 True Market Estimate - Top 25 Destinations					
Rank	**Destination**	**BIS Reported Pax**	**Diverted Pax**	**True Market**	**DPEW**
1	Las Vegas, NV	55,005	1,043	56,048	76.8
2	Denver, CO	42,783	1,617	44,400	60.8
3	Phoenix, AZ (AZA)	41,339	0	41,339	56.6
4	Orlando, FL (SFB)	29,100	0	29,100	39.9
5	Minneapolis, MN	23,870	3,056	26,926	36.9
6	Dallas, TX (DFW)	16,603	339	16,942	23.2
7	Phoenix, AZ (PHX)	11,587	760	12,347	16.9
8	Seattle, WA (SEA)	10,608	1,113	11,721	16.1
9	Chicago, IL (ORD)	10,555	933	11,489	15.7
10	Washington, DC (DCA)	9,096	914	10,010	13.7
11	Houston, TX (IAH)	7,455	1,929	9,384	12.9
12	Los Angeles, CA	8,299	1,069	9,368	12.8
13	Orlando, FL (MCO)	7,519	1,041	8,560	11.7
14	San Francisco, CA	7,223	453	7,677	10.5
15	Atlanta, GA	6,217	1,106	7,324	10.0
16	Portland, OR	6,888	336	7,224	9.9
17	San Diego, CA	6,370	531	6,901	9.5
18	Salt Lake City, UT	6,091	656	6,747	9.2
19	New York, NY (LGA)	5,231	648	5,880	8.1
20	Nashville, TN	4,745	915	5,659	7.8
21	Kansas City, MO	5,105	113	5,217	7.1
22	San Antonio, TX	4,148	828	4,975	6.8
23	St. Louis, MO	4,240	725	4,965	6.8
24	Boston, MA	4,188	374	4,562	6.2
25	Detroit, MI	2,951	1,265	4,216	5.8
	Top 25 destinations	**337,219**	**21,762**	**358,981**	**491.8**
	Total domestic	**477,776**	**38,689**	**516,465**	**707.5**
	Total international	**29,536**	**1,975**	**31,511**	**43.2**
	All markets	**507,312**	**40,664**	**547,976**	**750.7**

Source: Mead & Hunt, 2016

Note: DPEW = daily passengers each way (i.e., both arriving and departing passengers)

BIS Reported PAX = Passengers using BIS

Diverted PAX = passengers using another airport

True market = total number of passengers from the BIS market area including those who used other airports

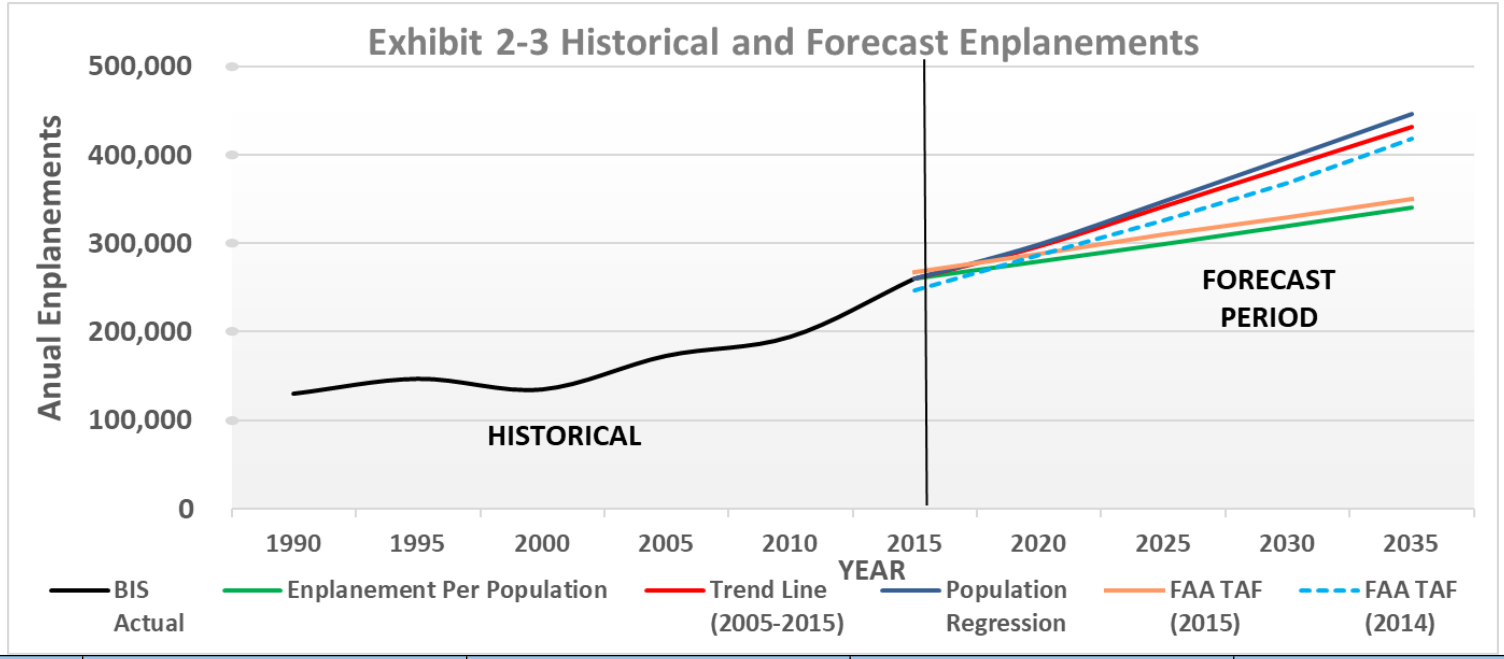
Review of prior planning documents suggests that these r values may overstate the relationship between these variables and enplanements. The 2008 Bismarck Airport Master Plan included regression analyses of similar factors and found a weak correlation of these variables with enplanements. The high r values in this Master Plan's correlation analysis are likely influenced by these variables trending in light of greater economic growth in recent years and do not necessarily indicate that growth of one variable causes enplanements to go up on its own.

Nonetheless, it is appropriate to use this correlation analysis to select a socioeconomic factor to utilize in forecasting enplanements. Due to the concern of the overstated strength of the four variables noted in the prior paragraph, total MSA population has been selected. The region's total population is more stable and less sensitive to economic fluctuations like the oil boom than other economic factors that also showed high correlations to enplanements.

Regression Analysis

Regression analysis is a common method of forecasting passenger enplanements. Regression analysis tests the strength of the relationship between an external factor (i.e., service area population or regional per capita income) and the number of passenger enplanements. It also produces an equation that enables one to forecast enplanements based on one or more other variables.

Population is the most stable of the four variables evaluated in that it varies the least year to year. A regression model was developed utilizing historical population and enplanement data from 2000 to 2012. This time period was selected to exclude the years when the oil exploration boom most influenced enplanements at Bismarck Airport (2012-2015).



Year	FAA Baseline		LOW – Rejected	MODERATE - Preferred	HIGH - Rejected
	FAA TAF (2014)	FAA TAF (2015)	Enplanement Per Population	Trend Line (2005-2015)	Population Regression
2015	246,450	267,147	259,734	259,734	259,734
2020	287,347	288,087	279,079	296,308	298,386
2025	325,576	309,597	299,066	341,525	346,945
2030	367,799	329,589	319,362	386,743	396,251
2035	417,692	350,032	339,856	431,961	446,041
20-Year CAGR	2.6%	1.4%	1.3%	2.7%	2.9%

Source: FAA 2015 and 2016 TAF; Mead & Hunt, 2016

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This methodology produces a forecast of:

- 289,386 enplanements in 2020
- 346,945 enplanements in 2025
- 396,251 enplanements in 2030
- 446,041 enplanements in 2035

This forecast is compared to the 2014 and 2015 TAF in **Exhibit 2-3**.

Trend Line Analysis

A second forecasting approach was to calculate the trend of historical enplanements for Bismarck Airport and extend this trend through the 2035 forecast period. This trend line will reflect the mix of local and national factors that have historically shaped enplanements at Bismarck Airport. A forecasting method that includes local factors is important, because historical enplanements at Bismarck Airport have had a weak correlation with national enplanement trends:

- National mainline and regional passenger enplanements: r = -0.11
- National mainline passenger enplanements: r = -0.16
- National regional passenger enplanements: r = 0.35

The trend line was calculated for the period of 2005-2015. This period has been selected because it includes both the recent years (2011-2015) in which the oil exploration boom appears to have had the greatest effect on enplanements, as well as seven prior years.

The annual growth rate for this period was 2.7 percent. Applying this growth rate to the 20-year forecast period yields a projection of:

- 296,308 enplanements in 2020
- 341,525 enplanements in 2025
- 386,743 enplanements in 2030
- 431,961 enplanements in 2035

Exhibit 2-3 compares all three Master Plan forecasts with the 2014 and 2015 TAF.

Enplanement per Population Ratio

Another common means of forecasting enplanements is to utilize the ratio of enplanements to the population served by an airport. This ratio represents area residents' historical pattern of airline use. Factors that affect this ratio include disposable income, geographic remoteness, airfares, and proximity to alternative airports. In 2015, Bismarck Airport had 2.09 enplanements per person in the Bismarck MSA (by comparison, the ratio was 1.64 enplanements per person in the Bismarck catchment area). Applying this ratio to the population forecast for the Bismarck MSA produces a projection of:

- 279,079 enplanements in 2020
- 299,066 enplanements in 2025
- 319,362 enplanements in 2030
- 339,856 enplanements in 2035

This forecast is compared to the 2014 and 2015 TAF in Exhibit 2-3.

Preferred Enplanement Forecast

The purpose of the enplanement forecast is to guide development of terminal and airfield facilities to support growth. Both the high forecast (regression analysis) and low forecast (enplanement per population ratio) use the Bismarck MSA as a factor. The Passenger Demand Analysis indicated that 93 percent of residents within the Bismarck catchment area (see Exhibit 2-2) who made airline flights used the Bismarck Airport. However, in 2014-2015 42.8 percent of Bismarck Airport passengers originated from outside of Bismarck's catchment area. With this large a segment of passengers originating outside of the catchment area, the local population can only have a weak direct relationship to total enplanements. Therefore, both the high and low forecasts have been rejected.

The trend line incorporates the contribution of population, local and national economy, and other factors that shaped historical passenger volumes. Because it captures a broader range of factors, it is judged superior to forecasts solely linked to area population. Therefore, the intermediate forecast (trend line) has been selected as the preferred forecast of passenger enplanements.

The trend line forecast anticipates a 2.7 percent compound average growth rate (CAGR) over the next 20 years (through 2035). The CAGR from 2000 to 2015 was 4.5 percent. This higher historical CAGR was influenced by a few years of high growth associated with the beginning of the oil boom where peak year-over-year growth of up to 20.2 percent was experienced.

Comparison with the 2015 Terminal Area Forecast

Master plan forecasts must be evaluated for consistency with the current TAF. Forecasts are considered consistent with the TAF if the five-year forecast is within 10 percent of the TAF and ten-year forecasts are within 15 percent of the TAF. As shown in **Table 2-8**, the preferred enplanement forecast is consistent with the 2015 TAF

Table 2-8 Comparison of Passenger Enplanement Forecasts				
Year	**2015 TAF**	**Preferred Forecast**	**Difference**	**% Difference**
2015	267,147	259,734	-7,413	-2.8%
2020	288,087	296,308	8,221	2.9%
2025	309,597	341,525	31,928	10.3%
2030	329,589	386,743	57,154	17.3%
2035	350,032	431,961	81,929	23.4%

Source: 2015 Terminal Area Forecasts, Aviation Forecasts complied by Mead & Hunt

2.6 BASED AIRCRAFT

Based aircraft are defined as those stored at an airport on a long-term basis. These aircraft owners buy or lease hangar and parking space from the airport or a third-party developer. The forecast of based aircraft will be used to identify the number of additional hangar spaces which need to be included in this master planning effort. The projected mix of aircraft types will guide planning by defining the size of hangars that will be needed. This information will also be used to assess the need for new or expanded supporting facilities or services.

2.6.1 Historical Patterns

In 2015, there were 117 based aircraft at Bismarck; 100 civilian aircraft (85 percent of the based fleet), and 17 military aircraft (15 percent of the based fleet). Military aircraft based at the Airport are listed in **Table 2-9** and civilian aircraft are described below. Military and civilian aircraft are classified separately because civilian aircraft numbers fluctuate due to market forces,

Table 2-9 Military Aircraft Based at Bismarck North Dakota Army National Guard	
8	UH-60 Blackhawk Helicopters
8	UH-72 Lakota Helicopters
1	C-12 Huron (Beechcraft King Air 200)

Source: Army National Guard

whereas military aircraft numbers fluctuate due to orders from the Department of Defense. For this reason, the forecast for based aircraft holds military numbers constant and focuses on civilian aircraft only.

- 65—Single-engine
- 22—Multi-engine
- 10—Jet
- 3—Helicopter
- 100—Based aircraft

The single-engine aircraft make up 65 percent of the based aircraft fleet at Bismarck Airport, and are mostly piston-powered aircraft with two to six seats. The piston-powered, twin-engine aircraft are a mixture of Cessna, Piper, and Beech makes. The twin turboprops are various models of the Beechcraft King Air series. The jets are in the small to mid-sized range (i.e., less than 30,000-pound gross takeoff weight). Most of the jets are various models of the Cessna Citation. However, Falcon, Gulfstream, and Beechcraft jet aircraft are also based on the field. The helicopters are single-rotor Bell models.

Over the last 15 years there has been volatility in the total number of civilian based aircraft. Total counts have been as high as 111 (in 2005) and as low as 78 (in 2010)[1]. As can be seen in **Exhibit 2-4**, the principal source of this volatility are periodic changes in the number of single-engine aircraft, which make up the majority of the based aircraft fleet. To a lesser degree, multi-engine aircraft have also contributed to the changes in based aircraft. During this same 15-year time period, the general trend for multi-engine aircraft has been of minor year-to-year variability with totals around 20 aircraft. The trend for jet aircraft has generally been one of growth over this time period. The greatest year-to-year increase in based jets occurred in the 2004-2011 period, when the number

[1] The numbers quoted are from the Terminal Area Forecast (TAF) with 2015 data coming from Airport records. There are small differences in some years between the TAF and Airport Master Record (Form 5010-1).

increased from four to ten. Helicopters are a small part of the fleet and have remained stable over recent years.

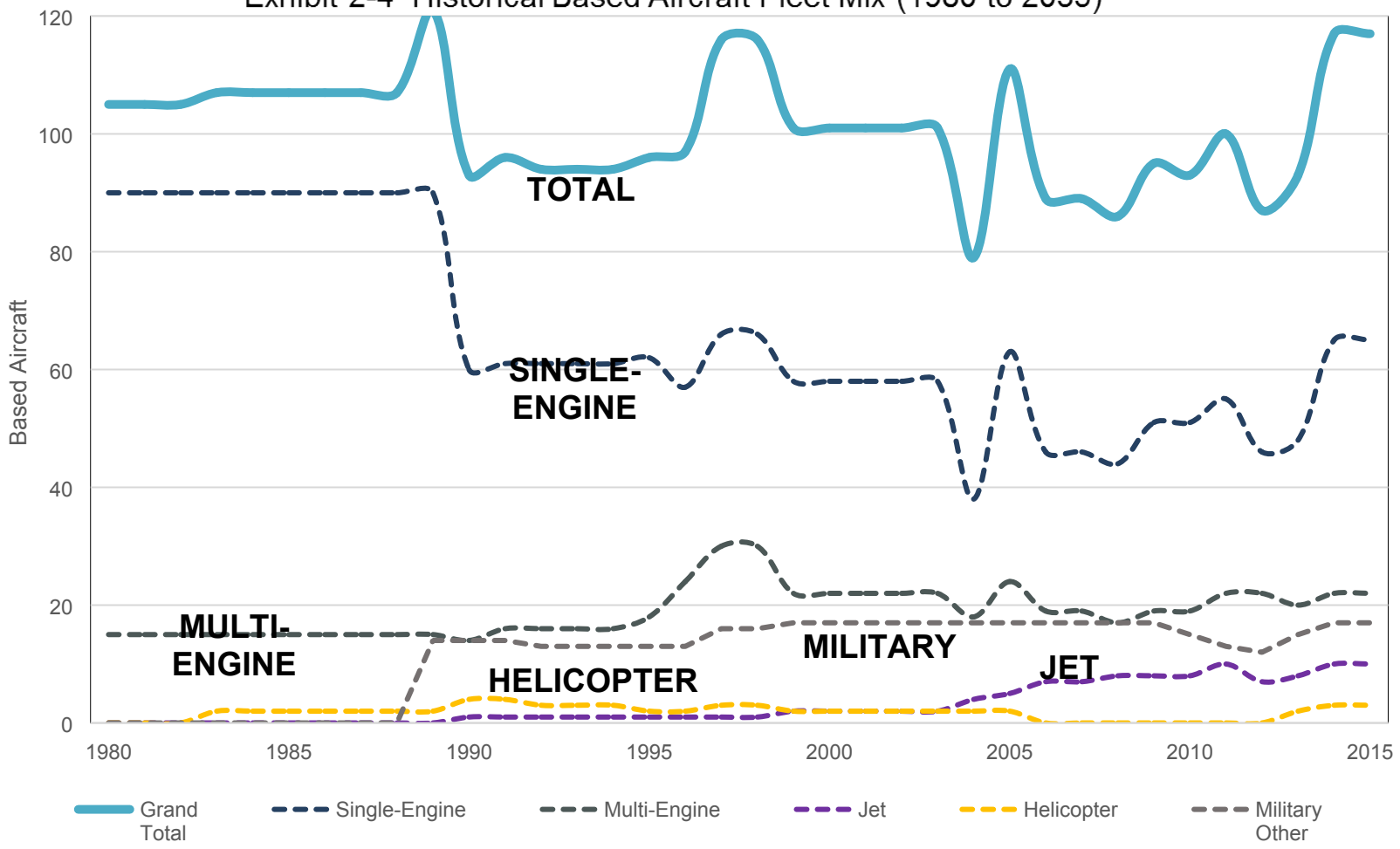
2.6.2 Based Aircraft Forecasting Methodology

Two forecast methodologies have been prepared for based aircraft: “high” and “low”. Based aircraft growth at the airport has exceeded national trends. Since 2008, the total number of based aircraft has increased from around 90 to 117, which equates to 4.5 percent growth per year. This may have been related to oil exploration boom and associated economic growth in the area as no other factors have been identified that could explain the strong growth trend. As noted in the General Forecasting Approach section, a similar energy boom could occur in the near-term. Therefore, it is appropriate to have a high forecast that captures this boom potential for purposes of facility planning. Because it is not possible to predict when the next oil exploration boom will occur, a low forecast was prepared that reflects base trends during non-boom periods.

The high forecast is intended to account for the oil exploration boom period’s impact on based aircraft at the airport. The high forecast of based aircraft was developed by projecting a trend line using the total number of based aircraft at Bismarck Airport for each of the last 11 years, which is believed to represent a full cycle of the boom. The high forecast projects 150 based aircraft by 2035.

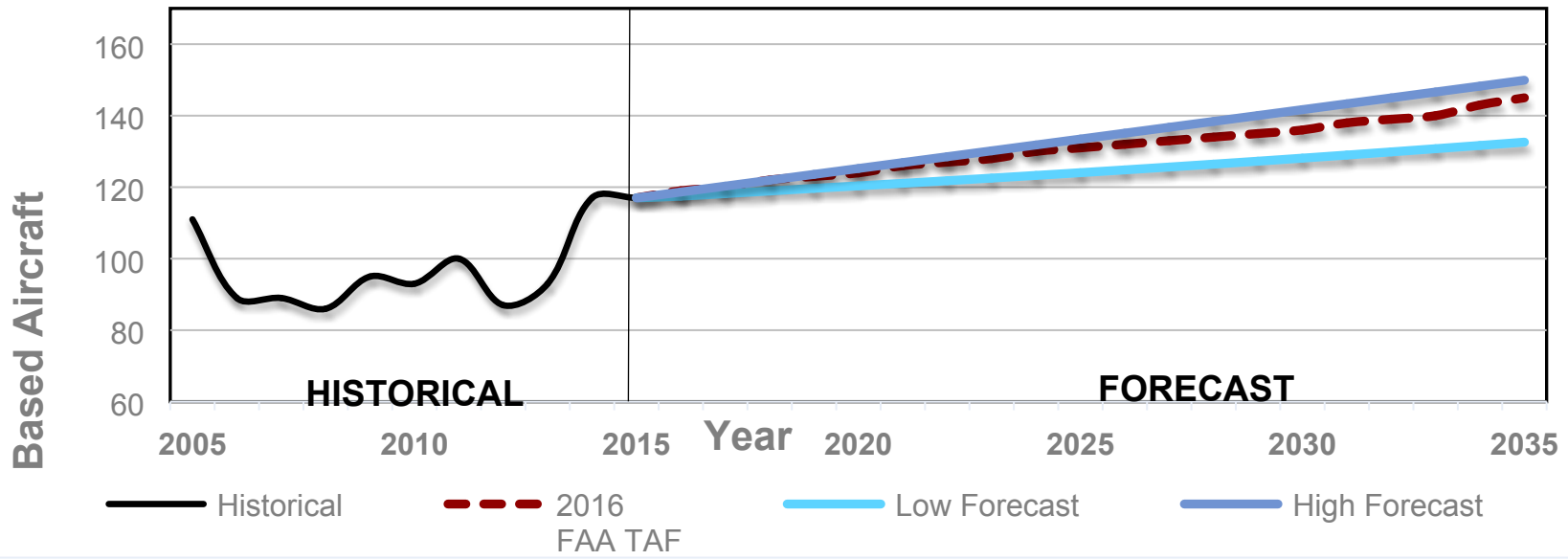
The low forecast focuses on growth in based aircraft outside of boom years. The low forecast was created by separately projecting growth rates for six categories of aircraft using forecast rates taken from the Aerospace Forecast. These growth rates show strong growth by jet, turbo prop, and helicopter aircraft, and a slow decline by single- and multi-engine piston aircraft. The low forecast projects 133 based aircraft by 2035. The high and low forecasts are presented in **Exhibit 2-5** and **Table 2-10**.

Exhibit 2-4 Historical Based Aircraft Fleet Mix (1980 to 2035)



Note: Total includes civilian and military

Exhibit 2-5 Historical and Forecast Based Aircraft



Year	FAA TAF (2016)	Master Plan Low - Preferred	Master Plan High- Rejected
2015	117	117	117
2020	124	120	125
2025	131	124	133
2030	136	128	142
2035	145	133	150
CAGR	**1.08%**	**0.64%**	**1.25%**

Table 2-10 Mix of Based Aircraft Types Historical and Forecast			
Aircraft Type	**2015**	**2035 Forecast**	
		Low	**High**
Total (Civilian + Military)	**117**	**133**	**150**
CAGR	**--**	**0.63%**	**1.25%**
Civilian			
Total Civilian	**100**	**116**	**133**
Single-Engine Piston	63	70	75
Twin-Engine Piston	15	13	15
Single-Engine Turboprop	2	3	3
Twin-Engine Turboprop	7	9	12
Jet - Small Cabin	8	14	17
Jet - Medium/Large Cabin	2	3	4
Helicopter	3	4	6
CAGR	**--**	**0.73%**	**1.43%**
Military - North Dakota Army National Guard			
Total Military	**17**	**17**	**17**
Helicopter	16	16	16
Fixed-Wing	1	1	1

Source: Mead & Hunt, 2016

Fleet Mix

As is shown in Table 2-10, both Master Plan forecasts anticipate a shift in the percentages of aircraft types during the 20-year forecast period. This reflects national trends contained in the Aerospace Forecast which project a reduction in the total number of single-engine piston aircraft and an increase in the number of turboprop and jet aircraft.

Preferred Based Aircraft Forecast

The Low Forecast of based aircraft has been selected as the preferred forecast. While it is possible that a new oil exploration boom would trigger a return in the rapid growth in

based aircraft, the timing of this resurgence is not possible to predict. Therefore, the High Forecast has not been selected.

Comparison with the 2015 Terminal Area Forecast

As noted at the beginning of this Chapter, Master Plan forecasts must be evaluated for consistency with the current TAF. Forecasts are considered consistent with the TAF if the five-year forecast is within 10 percent of the TAF and 10-year forecasts are within 15 percent of the TAF. As shown in **Table 2-11**, the preferred based aircraft forecast is below, but consistent with the 2015 TAF. The reason for the large gap between the TAF and the Preferred Forecast is because the Master Plan Forecast is considering the slowing of the oil exploration boom while the TAF was prepared when the boom was still occurring. The Preferred Forecast uses more recent local input information than the TAF.

Table 2-11 Comparison of Based Aircraft Forecasts

Year	2015 TAF	Preferred Forecast	% Difference
2020	124	120	-3.2%
2025	131	124	-5.3%

Source: Mead & Hunt, 2016

2.7 AIRCRAFT OPERATIONS

The forecast of operations will be used to determine whether the airfield will need capacity improvements during the next 20 years to accommodate expected demand.

2.7.1 Historical Pattern

Bismarck Airport supports the full range of aviation uses including:

- Scheduled passenger service with airline aircraft as large as the Airbus A320.

- The entire spectrum of general aviation aircraft from single-engine piston aircraft to corporate jets.
- Air cargo and air mail operations.
- A military air base with both helicopters and a fixed-wing turboprop.

The North Dakota Air National Guard unit based at Bismarck Airport is responsible for the training, operations, and maintenance of the helicopter and fixed-wing aircraft assigned to this location. Its official mission is "to conduct aviation operations by providing Command and Control, Air Movement and Air Assault Operations and Reconnaissance Support Operations to designated military or civilian authorities in support of state or local agencies or the Department of Defense or The Department of Homeland Security."[2] Additionally, four Army medevac helicopters based in Fargo, North Dakota use Bismarck Airport monthly. Total military operations have averaged 3,267 annually over the last 3 years (2013-2015). The base commander indicated that annual operations are expected to remain consistent for the foreseeable future.

Given the many changes that have occurred in aviation since 1990, there is surprising consistency in the number of annual operations at Bismarck Airport. In broad terms, the pattern in the operations at Bismarck Airport can be summarized as follows:

- During the 1990s, total operations averaged 60,000 annually.
- Near the end of the 1990's the volume of operations averaged 55,000 annually and remained at this level through the mid-2000s.
- As the effects of the recession were felt in 2009, operations declined to 45,000 annually.
- Starting in 2010 operations rose to approximately 55,000 annually.

[2] Taken from an e-mail from Lieutenant Colonel Paul R. Helten, Army Aviation Support Facility Commander to Barton Gover, Mead & Hunt, dated January 11, 2016.

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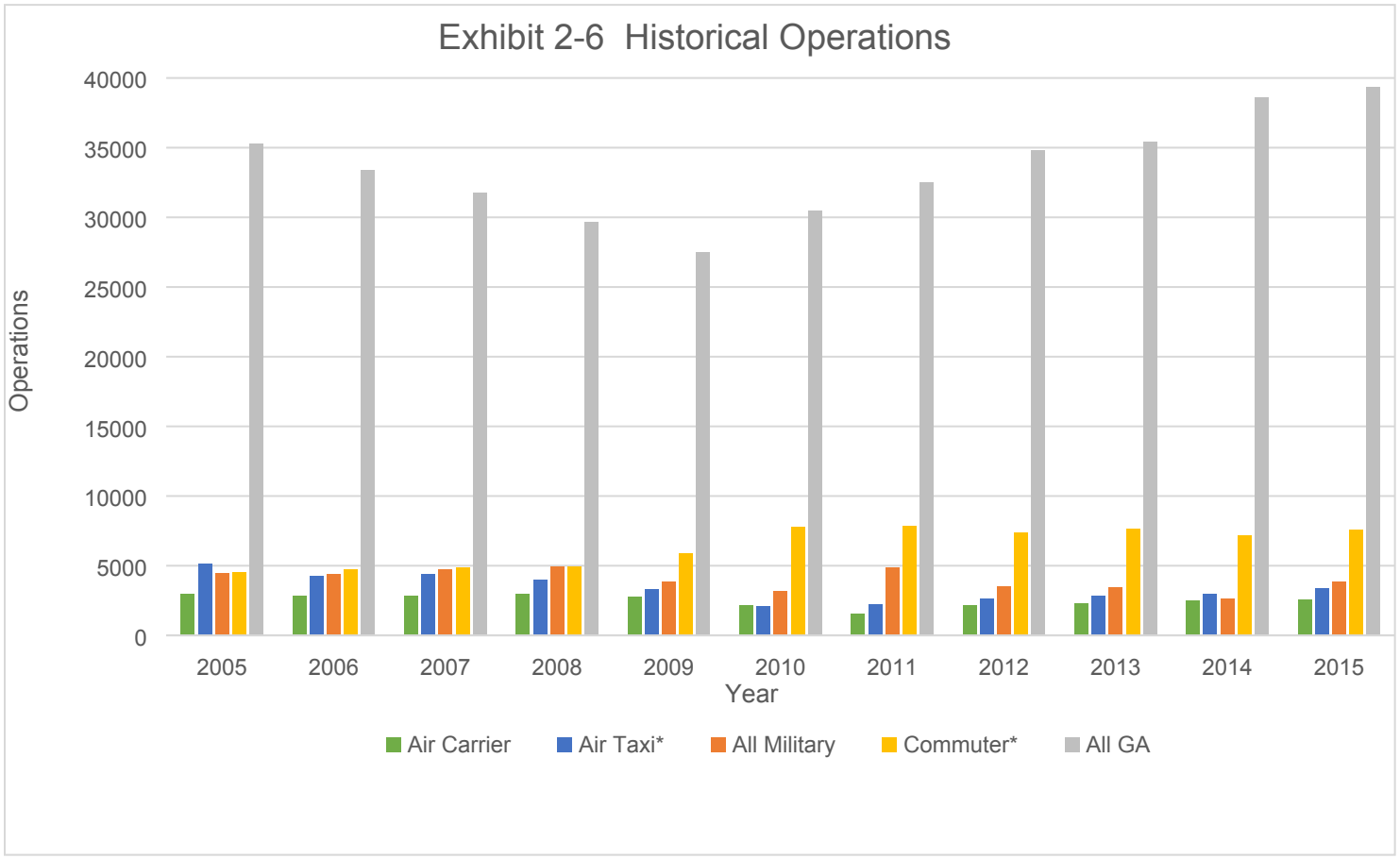

Source: Bismarck Air Traffic Control staff. *Air taxi and commuter airlines are combined in most FAA data sources. They are separated here to show changes to both forms of scheduled passenger service, air carrier and commuter.

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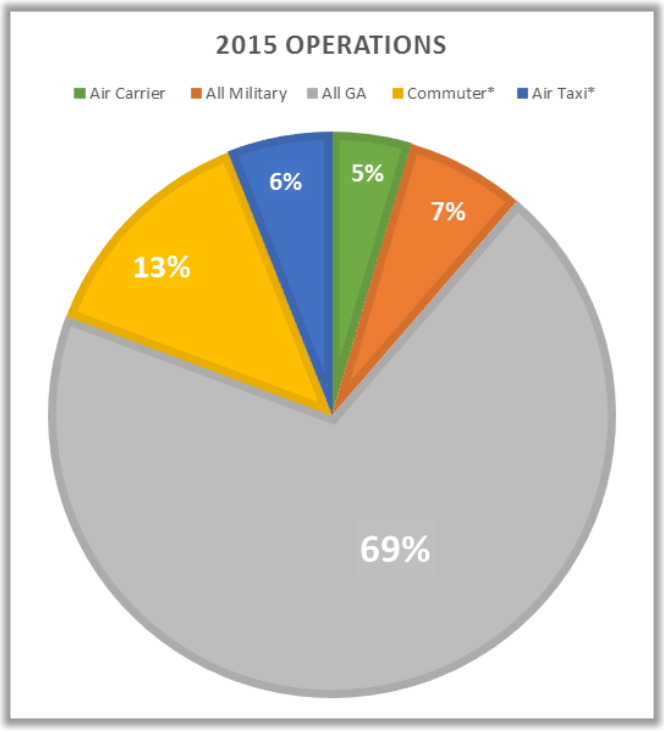
Exhibit 2-6 illustrates how the operations of various classes of aircraft have varied over the last 11 years. **Exhibit 2-7** shows the mix of operations for 2015 in more detail.

Exhibit 2-7



Source: Bismarck Air Traffic Control staff

2.7.2 Forecasts

Forecasts for total operations are a composite of individual forecasts by operation type. Operations types individually forecasted include scheduled passenger airlines, general aviation aircraft, and military aircraft. General aviation operations forecasts include air taxi and scheduled aircraft cargo operations that are not part of the scheduled airline forecasts. The results are then totaled to produce a forecast of annual operations.

Operations are classified as either itinerant, meaning they originate and depart from different airports; or local, meaning that the flight remains near the airport. Local operations are normally only conducted by general aviation and military aircraft for purposes of flight training and recreation.

Scheduled Passenger Airlines

The forecast of operations by scheduled airliners was derived from the forecast of passenger enplanements presented in Section 2.5.2 of this Chapter. The forecasted compounded average annual growth rate of 2.7 percent (shown in Table 2-3) was based upon the trend of historical enplanements. Note that the forecast of enplanements includes passengers on air carrier and commuter airlines. This previously forecast annual enplanements was divided by projected average seats per departure and then average passenger loads to calculate the number of annual operations.

Historical average seats per departure and load factors were calculated using data from the U.S. Department of Transportation's T100 data base. The results for the most recent six years (2010-2015) are shown in **Table 2-12**. Methodologies for forecasting average seats per departure and load factors are discussed in the paragraphs that follow.

There are several distinct groups of aircraft types currently serving Bismarck Airport. The airport's average seats per departure will be shaped by changes in the mix of aircraft types over time. **Table 2-13** shows that there are currently five aircraft with 50 seats, one with 65 seats, and four aircraft having more than 100+ seats serving Bismarck Airport. Current airline industry trends suggest that within 10 years most of the aircraft of this size will be replaced by aircraft with 70 to 76 seats.

Table 2-12 Scheduled Commercial Operations Forecast							
	Year	Scheduled Pass. Enplanements	Scheduled Airline Departures	Avg. Enplaned Pass. Per Departure	Avg. Aircraft Seats per Departure	Scheduled Airline Operations	Avg. Load Factor
Historical	2010	194,043	4,358	44.5	65.7	8,716	71.7%
	2011	196,414	4,031	48.7	63.6	8,062	78.7%
	2012	236,172	4,294	55.0	67.1	8,588	83.5%
	2013	237,683	4,283	55.5	68.8	8,566	81.7%
	2014	245,205	4,239	57.8	70.1	8,478	83.9%
	2015	259,734	4,639	56.0	70.0	9,278	80.2%
	CAGR	***6.0%***	***1.3%***	***4.7%***	***1.3%***	***1.3%***	***2.3%***
Forecast	2016	260,134	4,569	56.9	71.0	9,139	80.2%
	2017	269,177	4,679	57.5	71.7	9,358	80.2%
	2018	278,221	4,786	58.1	72.4	9,572	80.2%
	2019	287,264	4,891	58.7	73.2	9,783	80.2%
	2020	296,308	4,944	59.9	74.7	9,889	80.2%
	2021	305,351	5,054	60.4	75.3	10,108	80.2%
	2022	314,395	5,162	60.9	75.9	10,325	80.2%
	2023	323,438	5,269	61.4	76.5	10,537	80.2%
	2024	332,482	5,373	61.9	77.1	10,747	80.2%
	2025	341,525	5,476	62.4	77.7	10,953	80.2%
	2026	350,569	5,576	62.9	78.4	11,152	80.2%
	2027	359,612	5,674	63.4	79.0	11,348	80.2%
	2028	368,656	5,771	63.9	79.6	11,541	80.2%
	2029	377,700	5,866	64.4	80.3	11,731	80.2%
	2030	386,743	5,959	64.9	80.9	11,918	80.2%
	2031	395,787	6,049	65.4	81.5	12,099	80.2%
	2032	404,830	6,138	66.0	82.2	12,276	80.2%
	2033	413,874	6,225	66.5	82.9	12,451	80.2%
	2034	422,917	6,311	67.0	83.5	12,623	80.2%
	2035	431,961	6,396	67.5	84.2	12,792	80.2%
	CAGR	***1.9%***	***1.3%***	***0.6%***	***0.6%***	***1.3%***	***0.0%***

Note: National "average seats/departure" were approximated by using "average seats/passenger mile"

Sources: Bismarck Airport Historical seat data - U.S. Department of Transportation T100 database.
Bismarck Airport Enplanement Projections - Mead & Hunt, 2016

Table 2-13 Scheduled Airline Seats Per Departure				
Airline	**Aircraft Type**	**Departures/Week**	**Seats**	**Seats/Departure**
American	ERJ-145	7	350	50
Delta	CRJ	18	900	50
Delta	CRJ-700	9	585	65
Delta	MD-88	4	596	149
Allegiant	A319	3	468	156
Allegiant	MD-80	5	830	166
Allegiant	A320	2	354	177
United	CRJ-200	17	850	50
United	ERJ-145	8	400	50
Frontier	A319	3	468	156
	TOTAL	**83**	**6151**	
			Average Seats per Departure	**74**

Note: Data is for the week of February 4, 2016, except for data for Frontier. Frontier only provides service seasonally, so its data is from September 2015.

There is expected to be smaller incremental growth in average seats per departure for the larger aircraft serving the airport (e.g., MD-88 and Airbus A320). This is largely due to the expected retention of the Airbus A319 and A320, and MD-80 series aircraft continuing to serve Bismarck Airport through at least the next 10 years. The small number of larger aircraft which occasionally serve the airport as charters, such as the Boeing 757, is expected to increase which will incrementally raise the average seats per departure.

For the purposes of this forecast it has been assumed that the growth in seats per departure will continue at the current rate (1.3 percent/year) through 2020. In subsequent years the growth in seats per departure will follow the FAA's projected national trend for regional airlines (0.8 percent annually). This would result in average seats per departure at Bismarck Airport of:

- 74.7 in 2020
- 77.7 in 2025
- 80.9 in 2030
- 84.2 in 2035

Over the last six years (2010-2015) average load factors at Bismarck Airport have increased from the 70% range early in this period to the 80% range in recent years. This has also been the national trend for both regional and mainline carriers (see Table 2-12). For forecasting purposes, it has been assumed that the 2015 load factor (80.2 percent) will continue through 2035. Applying this load factor to the average number of departure seats yields an estimate of the average passengers per departure. Dividing this figure into the previously presented enplanement figures provides a forecast of the number of departures. This number is then doubled to reflect both departure and arrival operations. The resulting operations by scheduled airlines would be:

- 9,889 in 2020
- 10,953 in 2025
- 11,918 in 2030
- 12,792 in 2035

This information is also shown in **Table 2-14**.

General Aviation

As with other forecasts, the forecast of the general aviation component of total operations began with an evaluation of potential correlations between historical itinerant and local operations at Bismarck Airport with the sixty-four aviation and econometric factors mentioned previously in the chapter. Historical itinerant operations at Bismarck Airport had significant correlations with based aircraft (r = 0.79) and national ATP pilots (r = 79). However, there were not comparable strong correlations for local operations. The best correlation for local operations was national student pilots, but its correlation (r = 0.64) was below the threshold of 0.70 previously established. Because there were not significant correlations for both of the two components of general aviation operations, preparing separate forecasts of each was not possible.

As an alternative to regression analysis, a trend line was calculated using total annual general aviation operations at Bismarck Airport from 2005-2015. This method produced forecasts of:

2020	45,381	**2030**	48,153
2025	46,767	**2035**	49,539

This data is also presented in Table 2-14.

FAA forecasts are required to include projections of commercial operations. Commercial operations include both scheduled passenger service and on-demand air taxi operations. Air taxi operations (not including scheduled commuter flights) were estimated to average 6.6 percent in the years 2010-2014. In forecasting commercial operations it will be assumed that 6.6 percent of forecast general aviation operations will be by air taxi.

Military

In the years 2011-2015 military operations have averaged 3,267 operations per year. The commanding officer of the Army National Guard base at Bismarck Airport indicated that the volume of operations would remain about the same as current levels for the foreseeable future. Therefore, annual military aircraft operations will be assumed to remain at 3,267 in this forecast.

Operations Forecast

Combining the Master Plan forecast for airline, general aviation and military operations yields:

2020	58,537	**2030**	63,338
2025	60,987	**2035**	65,598

This data is also presented in Table 2-14 and **Exhibit 2-8**.

Table 2-14 Operations Forecasts

Year	General Aviation	Military	Airline	Total
2020	45,381	3,267	9,889	58,537
2025	46,767	3,267	10,953	60,987
2030	48,153	3,267	11,918	63,338
2035	49,539	3,267	12,792	65,598

Source: Mead & Hunt, 2016

Comparison with the 2015 Terminal Area Forecast

The table that is part of Exhibit 2-8 presents the calculated percentage difference between the preferred forecast and the 2015 Terminal Area Forecast. The preferred forecast falls within the limits to be considered consistent with the Terminal Area Forecast.

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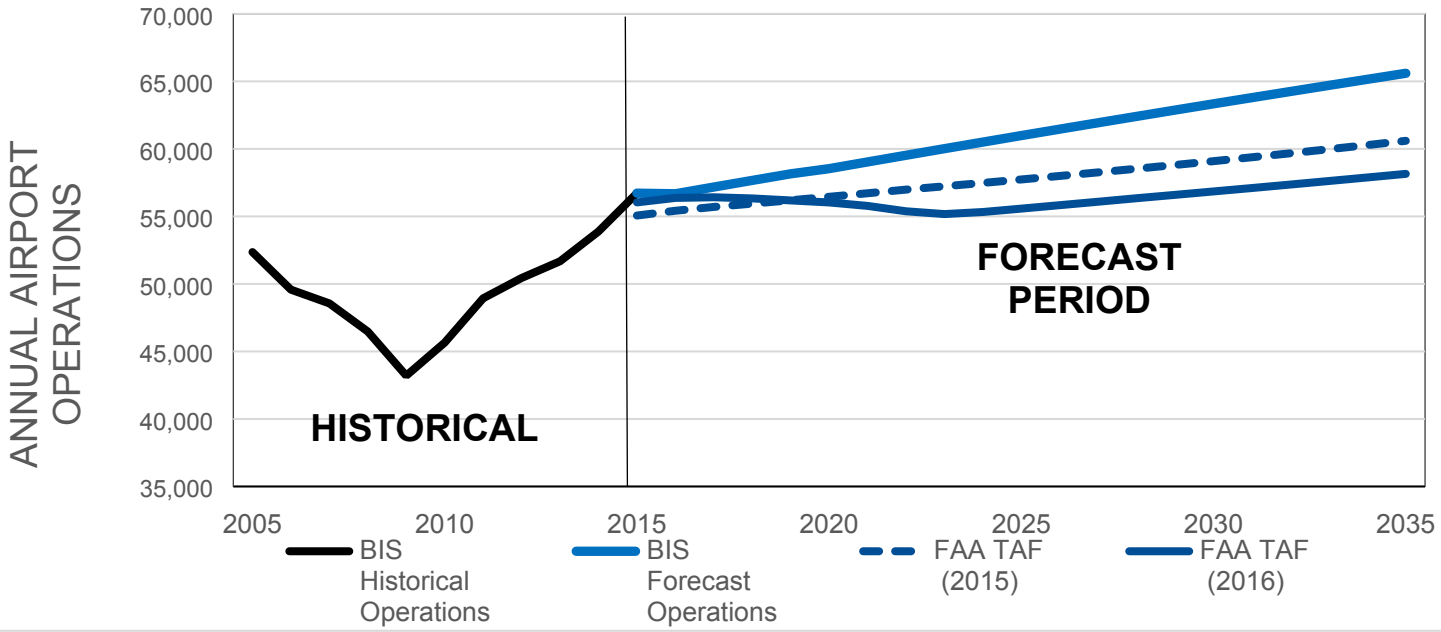
Exhibit 2-8: Historic and Forecast Operations, 2005-2035



Year	Bismarck Airport Total Operations Forecast	2014 TAF Forecast	% Difference 2014 TAF	2015 TAF Forecast	% Difference
2015	56,721	55,064	3.0%	56,037	1.2%
2020	58,537	56,452	3.7%	56,033	4.5%
2025	60,987	57,736	5.6%	55,577	9.7%
2030	63,338	59,092	7.2%	56,849	11.4%
2035	65,598	60,597	8.3%	58,149	12.8%
CAGR	**0.73%**	**0.48%**	**--**	**0.19%**	**--**

Source: 2015 Terminal Area Forecasts, Aviation Forecasts complied by Mead & Hunt

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Itinerant and Local Operations

Nationally, local operations at towered airports as a percentage of total operations have ranged around 28 percent for the last five years, remaining within 1 percent of that level. At Bismarck Airport, local operations averaged 28 percent of total operations over the past five years, but this percentage has shown up to 2.3 percent year-to-year variation. The Aerospace Forecast projects that nationally local operations will decline to 25.6 percent of total operations. This percentage is similar to the level reached at Bismarck Airport (25.4 percent) during the beginning of the recent recession in 2008. The 2015 TAF for Bismarck Airport projects a gradual climb to 28.0 percent by 2023 and then a slow decline to 27.5 percent in 2035. Historically local operations at Bismarck Airport have remained higher than national averages. The 2015 TAF projections remain in the range historically experienced at Bismarck Airport. Therefore, the TAF projections of the local percentages of operations are proposed to be used as the preferred forecast. The forecast local and itinerant percentages are shown in **Table 2-15**.

Table 2-15 Forecast of Percentages of Local and Itinerant Operations

Year	Local	Itinerant
2020	27.4%	72.6%
2025	28.0%	72.0%
2030	27.8%	72.2%
2035	27.5%	72.5%

Peak Operations Forecasts

Peak month operations are forecast based upon historical peak levels at Bismarck Airport. Over the last five years (2011-2015) the peak month has varied from 10.0 percent to 10.8 percent of total annual operations. The average of this time period is 10.4 percent. The peak month occurs during the summer but has varied from May to July. The peak day is calculated by dividing the peak month by the number of days in the peak month. The average peak day over the past five years (2011-2015) was 0.34 percent of annual operations. For forecasting purposes, it is assumed that the average day will continue to be 0.34 percent of annual operations. Applying this percentage to the previously presented operations forecast yields the operations on the average day peak month

shown in **Table 2-16**. The number of operations in the peak hour was estimated at 12.0 percent based upon a common industry average for airports with greater than 40,000 annual operations. If it is assumed that this percentage will remain constant during the 20-year forecast period, peak hour operations will increase from 22 in 2015 to 28 in 2035. Intermediate forecasts are shown in **Table 2-17**.

Table 2-16 Historical Operations Peak Month

Year	Peak Month	Peak Month % of Annual Operations	Average Day % of Peak Month
2011	June	10.3	0.34
2012	July	10.8	0.35
2013	July	10.4	0.34
2014	May	10.3	0.33
2015	July	10.0	0.32
	Average %	**10.4**	**0.34**

Source: Bismarck Airport records

Table 2-17 Forecast PMAD Peak Hour Operations

Year	Bismarck Airport Operations Forecast	Peak Month %	Peak Month Operations	PMAD Operations	Peak Hour %	Peak Hour Operations
2020	58,537	10.4%	6,088	207	12%	25
2025	60,987	10.4%	6,343	216	12%	26
2030	63,338	10.4%	6,587	224	12%	27
2035	65,598	10.4%	6,822	232	12%	28

PMAD = Peak Month Average Day

Source: Mead & Hunt, 2016

IFR Operations Forecasts

As can be seen in **Table 2-18**, IFR operations have averaged about 45 percent of total operations at Bismarck Airport for the last five years (2011-2015). No factors have been identified that would cause this historical percentage to change. Therefore, future IFR operations are forecast to remain at the average of the most recent five-year period: 45.4 percent. When this percentage is applied to the previously presented operations forecasts, the resulting forecast of IFR and VFR operations is as shown in **Table 2-19**.

Table 2-18 Historical IFR/VFR Operations		
Year	**IFR %**	**VFR %**
2011	43.1%	56.9%
2012	45.8%	54.2%
2013	47.5%	52.5%
2014	45.9%	54.1%
2015	44.9%	55.1%
Average	**45.4%**	**54.6%**

Source: FAA OPSNET

Table 2-19 Forecast IFR/VFR Operations				
Year	**% IFR**	**IFR Operations**	**% VFR**	**VFR Operations**
2020	45.4%	26,576	54.6%	31,961
2025	45.4%	27,688	54.6%	33,299
2030	45.4%	28,756	54.6%	34,583
2035	45.4%	29,781	54.6%	35,817

Source: Mead & Hunt, 2016

2.8 AIR CARGO

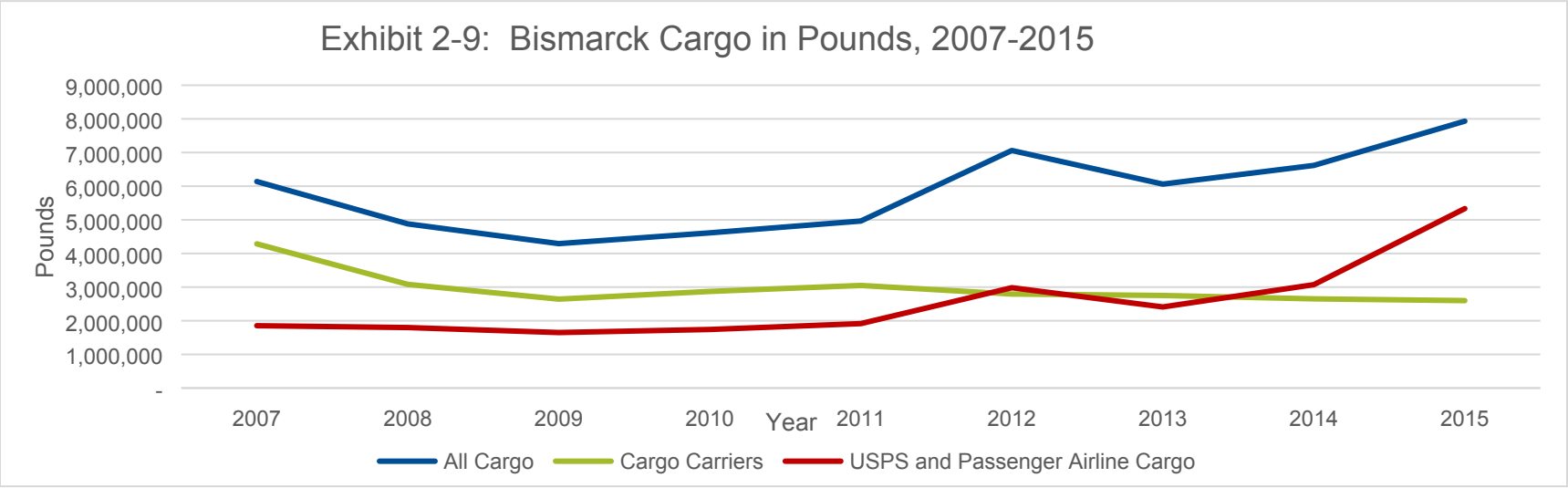
Air cargo activity at Bismarck Airport includes express package, U.S. mail, and general cargo. The forecast of air cargo volumes will be used to evaluate whether additional facilities are required to support these operations in the future.

2.8.1 Recent Trends

Detailed data on air cargo volumes is available from 2007-2015. The data includes inbound and outbound cargo volumes by carrier by month for the entire eight-year period. **Exhibit 2-9** presents the annual cargo volumes for packages (including on-demand freight), mail, and annual totals. As can be seen in the graph, package volumes have been slowly declining since 2007. For some cargo carriers the decline started in 2012, while others continued to increase until 2014. Mail volumes have been increasing since 2011. Examining the monthly data shows that the rate of increase in mail volumes peaked

in August 2015. Each month thereafter, the rate of increase slowed. In December 2015, there was a decrease of over 15 percent compared to the same month in 2014. These trends differ from the national trends discussed in Section 2.2.4.

The air freight carriers were interviewed in an effort to determine the source of the increases and decreases in cargo volumes. The mail carrier indicated that most of the recent increases in mail volumes were due to the recent energy boom. Package carriers indicated that some of the year-to-year changes were due to fluctuations in the energy sector. However, major on-line retailer policies such as free shipping were also cited as source of increases. The effect of on-line shipping was not sufficient to counteract the decline associated with the ending of the present oil boom but did delay the point at which volumes for individual cargo carriers began experiencing a decline.



* Note: Because only a small fraction (0.4%) of all cargo passing through Bismarck Airport is carried on scheduled passenger aircraft, data for this category has been combined with U.S. Mail volumes.

Historical Air Cargo Volumes (Millions of Pounds)			
Year	**Air Cargo**	**USPS**	**Total**
2007	4.3	1.9	6.1
2008	3.1	1.8	4.9
2009	2.6	1.6	4.3
2010	2.9	1.7	4.6
2011	3.0	1.9	5.0
2012	2.8	3.0	7.1
2013	2.8	2.4	6.1
2014	2.7	3.1	6.6
2015	2.6	5.3	7.9

Source: Bismarck Airport Records

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2.8.2 Air Cargo Forecasts

The general conclusion drawn from the historical data is that there would be only modest growth in air cargo volumes at Bismarck Airport without the effect of an energy boom in the state. Therefore, in forecasting cargo volumes, separate forecasts with and without the resumption of the energy boom were prepared.

Baseline Cargo Forecast

The Aerospace Forecast ties its forecast of domestic cargo volumes to changes in the U.S. gross domestic product. That document anticipates that national domestic cargo volumes will increase an average of 0.5 percent annually through 2035. This growth rate will be used as the base growth rate for air cargo at Bismarck Airport, that is, growth without the effect of an oil boom. Applying this growth rate to the 2015 total yields:

- 8.1 million pounds in 2020
- 8.3 million pounds in 2025
- 8.5 million pounds in 2030
- 8.7 million pounds in 2035

Energy Boom Cargo Forecast

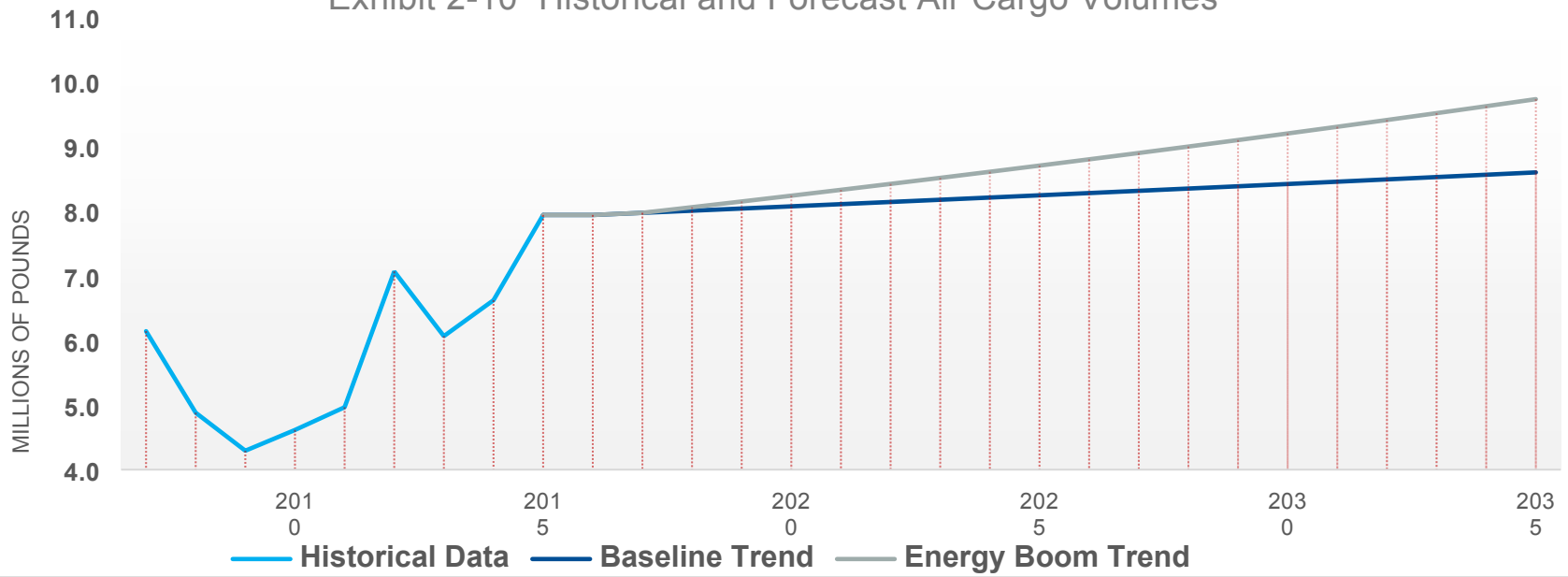
The long-term effect of a return of an oil boom was estimated by calculating the average annual growth rate at Bismarck Airport from 2009-2015. This growth rate (1.1 percent) is lower than the national average (1.4 percent) for domestic cargo during 2009-2014 (2015 national data was not available). This growth rate has been used for the forecast under the scenario which includes a return of the oil boom.

- 8.3 million pounds in 2020
- 8.8 million pounds in 2025
- 9.2 million pounds in 2030
- 9.8 million pounds in 2035

The effect of the ending of the recent oil boom is reflected in all forecasts. In the cargo forecasts it is assumed that the total cargo volume at Bismarck Airport will decrease in 2016 to the level that occurred in 2014 (i.e., about 6.9 million pounds). Under the baseline scenario, cargo volumes will begin growing at the national rate (0.5 percent annually) in 2017. Under the oil boom scenario, it assumed that the resurgence of the oil boom will begin in 2018. Exhibit 2-10 presents historical and forecast cargo volumes. Under the baseline scenario, about 8.7 million pounds of cargo will be shipped in 2035. Under the oil boom scenario this number would rise to 9.8 million pounds of cargo. Given the uncertainty of the return of an oil boom, the baseline forecast is the preferred forecast.

It is appropriate to note that Bismarck Airport has historically had a strong difference between inbound and outbound air cargo volumes. The Bismarck area is not a center for exporting of smaller, high-value items that would likely be shipped via air. Therefore, the historical pattern is heavily weighted towards inbound cargo. During strong periods of boom the percentage of inbound cargo averages around 75 percent. The percentage of inbound cargo decreases to around 70 percent during non-boom periods. It is anticipated that these ratios will continue through the forecasting period.

Exhibit 2-10 Historical and Forecast Air Cargo Volumes



Historical Air Cargo Volumes (Millions of Pounds)			
Year	**Air Cargo**	**USPS**	**Total**
2007	4.3	1.9	6.1
2008	3.1	1.8	4.9
2009	2.6	1.6	4.3
2010	2.9	1.7	4.6
2011	3.0	1.9	5.0
2012	2.8	3.0	7.1
2013	2.8	2.4	6.1
2014	2.7	3.1	6.6
2015	2.6	5.3	7.9

Source: Bismarck Airport Records

Year	Baseline Trend- Preferred	Energy Boom Trend- Rejected
2020	8.1	8.3
2025	8.3	8.8
2030	8.5	9.2
2035	8.7	9.8
CAGR	0.5%	1.1%

Source: Mead & Hunt, 2016

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2.9 Peak Passenger Activity

Some elements of terminal planning are based upon peak passenger activity. To support these analyses, the peak monthly, daily, and hourly activity levels for passengers for the most recent five calendar years (2011-2015) are first calculated. This data is then used to project these activity levels for the 20-year planning period.

2.9.1 Peak Month Passenger Activity Forecasts

Monthly passenger enplanement data for the period 2011-2015 is presented in **Table 2-20**. The average percentage of passengers in the peak month was 9.8 percent of total annual enplanements. In 4 of the 5 years, the peak month was December. In forecasting peak passenger activity, it will be assumed that December will continue to be the peak month and that enplanements for this month will remain at 9.8 percent of the annual total. Applying this percentage to the preferred annual enplanement forecast yields a peak month enplanement forecast. **Table 2-21** resents the complete forecast of peak monthly enplanements.

Table 2-20 Historical Monthly Enplanements

Month	2011	2012	2013	2014	2015
January	14,551	16,221	19,009	19,445	21,239
February	15,130	17,039	20,025	19,115	20,289
March	16,204	19,112	22,162	20,378	21,200
April	14,417	16,491	17,635	16,784	18,985
May	15,339	19,854	21,744	19,880	20,460
June	16,055	21,140	19,991	19,962	21,478
July	18,318	22,253	20,038	21,688	23,652
August	16,156	21,477	18,986	19,953	21,763
September	16,147	19,525	17,806	17,088	20,234
October	18,001	21,424	19,707	23,491	24,177
November	16,745	19,979	18,088	21,924	21178
December	19,351	21,657	22,492	25,497	25,079
Total Enplanements	196,414	236,172	237,683	245,205	259,734
Maximum Enplanements	19,351	22,253	22,492	25,497	25,079
Peak Month %	9.9%	9.4%	9.5%	10.4%	9.7%
Average % of Enplanements in Peak Month			9.8%		

Source: Bismarck Airport Records, Mead & Hunt, 2016

Table 2-21 Projected Peak Month Enplanements (Scheduled Carriers)			
Year	**Projected Annual Enplanements**	**Peak Month %**	**Peak Month Enplanements**
2020	296,308	9.8%	29,038
2025	341,525	9.8%	33,469
2020	386,743	9.8%	37,901
2035	431,961	9.8%	42,332

Source: Mead & Hunt,2016

2.9.2 Peak Month Average Day Passenger Activity Forecasts

Daily peak activity figures are based on a regularly occurring level of daily activity during the peak, or busiest, month. A review of airline activity schedules for the peak month of December 2015 indicates that activity regularly peaks on Sundays. Sunday typically has 15 departures and 15 arrivals and accounts for about 17.4 percent and 17.6 percent of weekly departing and arriving seats, respectively (Table 2-22). Considering the average peak month is 31 days long (4.4 weeks), the average number of weekly passengers in the peak month is calculated by dividing the number of total monthly passengers with the average number of weeks in the peak month. This figure is then divided by the percent of weekly activity that occurs on a typical Sunday to determine the average daily number of total passengers that are enplaned and deplaned in the peak month.

Table 2-22 Peak Month Average Day Passenger Projections						
Seats per Day (Scheduled Carriers)						
Day of the Week	Departures			Arrivals		
	Departures	Departing Seats	Percentage of Weekly Dep Seats	Arrivals	Arriving Seats	Percentage of Weekly Arrival Seats
Mon	13	911	13.3%	13	933	13.6%
Tue	13	929	13.6%	13	924	13.5%
Wed	14	1,025	15.0%	14	1,035	15.1%
Thu	14	1,116	16.3%	13	1,128	16.5%
Fri	11	780	11.4%	12	777	11.3%
Sat	12	897	13.1%	12	850	12.4%
Sun	15	1,191	17.4%	15	1,210	17.6%
Total	91	6,847		91	6,856	

Average Day Passengers (Scheduled Carriers)								
Year	Peak Month Enpl/Depl	Weeks in Peak Month	Avg Week Enpl/Depl	Percent of Weekly Activity on a Typical Sunday		Average Day Passengers		
				Enplaning	Deplaning	Enpl	Depl	Total Pass.
2015	25,079	4.4	5,679	13.1%	12.4%	744	704	1,447
2020	29,038	4.4	6,575	13.1%	12.4%	861	815	1,676
2025	33,469	4.4	7,578	13.1%	12.4%	993	939	1,932
2030	37,901	4.4	8,582	13.1%	12.4%	1,124	1,063	2,188
2035	42,332	4.4	9,585	13.1%	12.4%	1,256	1,188	2,443

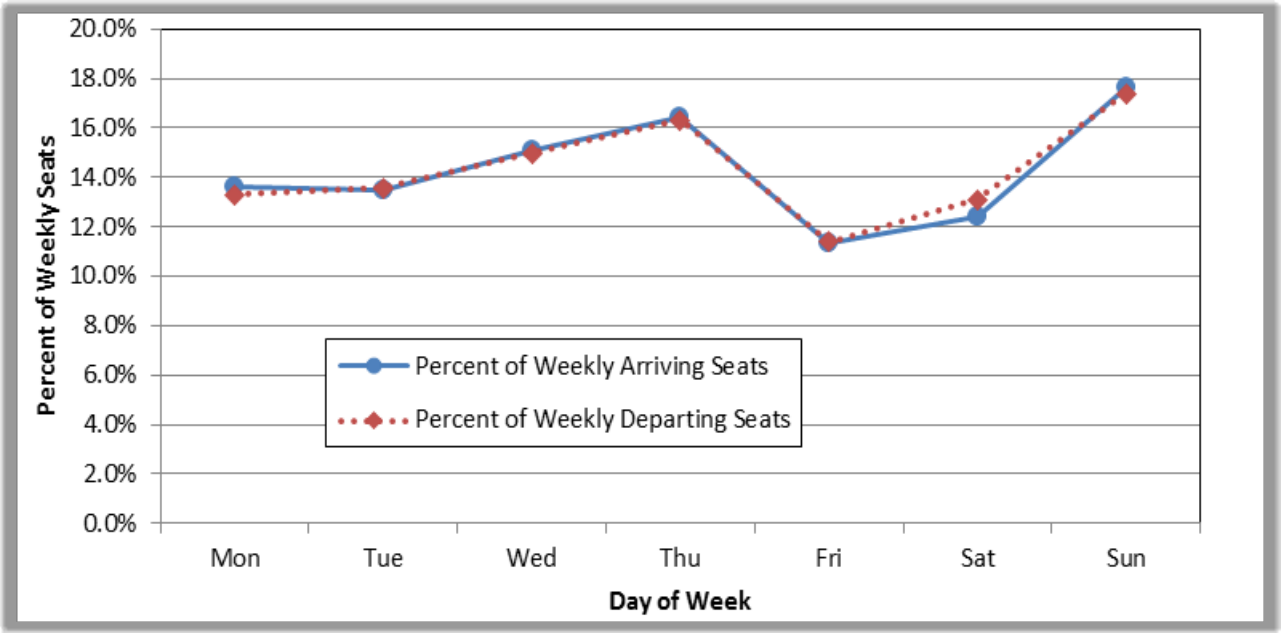


Table 2-23 Peak Hour Passenger Projections

2.9.3 Peak Hour Passenger Forecast

The number of hourly arriving and departing seats during a typical Sunday in the peak month (December) is shown in **Table 2-23**. Peak hour departing seats currently (December 2015) occur between 16:28 to 16:35 (4:28 p.m. to 4:35 p.m.). Peak hour arriving seats occur between 16:44 to 16:54 (4:44 p.m. and 4:54 p.m.). The peak total arriving and departing seats occurs between 16:44 to 16:54 (4:44 p.m. and 4:54 p.m.).

Peak hour passenger volumes through 2035 were calculated by applying the current (December 2015) peak hour percentages (described above) to the annual passenger volumes previously projected. These projected peak hour passenger volumes are presented in **Table 2-24**.

2.10 Design Aircraft

Plans for airport facilities must conform to FAA design standards. Design standards accommodate the physical and operational characteristics of the most demanding 'design aircraft'. In some cases, the design aircraft will actually be a composite of the characteristics of the most demanding aircraft. For airfield planning purposes the design aircraft is classified by three parameters:

- Aircraft Approach Category
- Airplane Design Group
- Taxiway Design Group

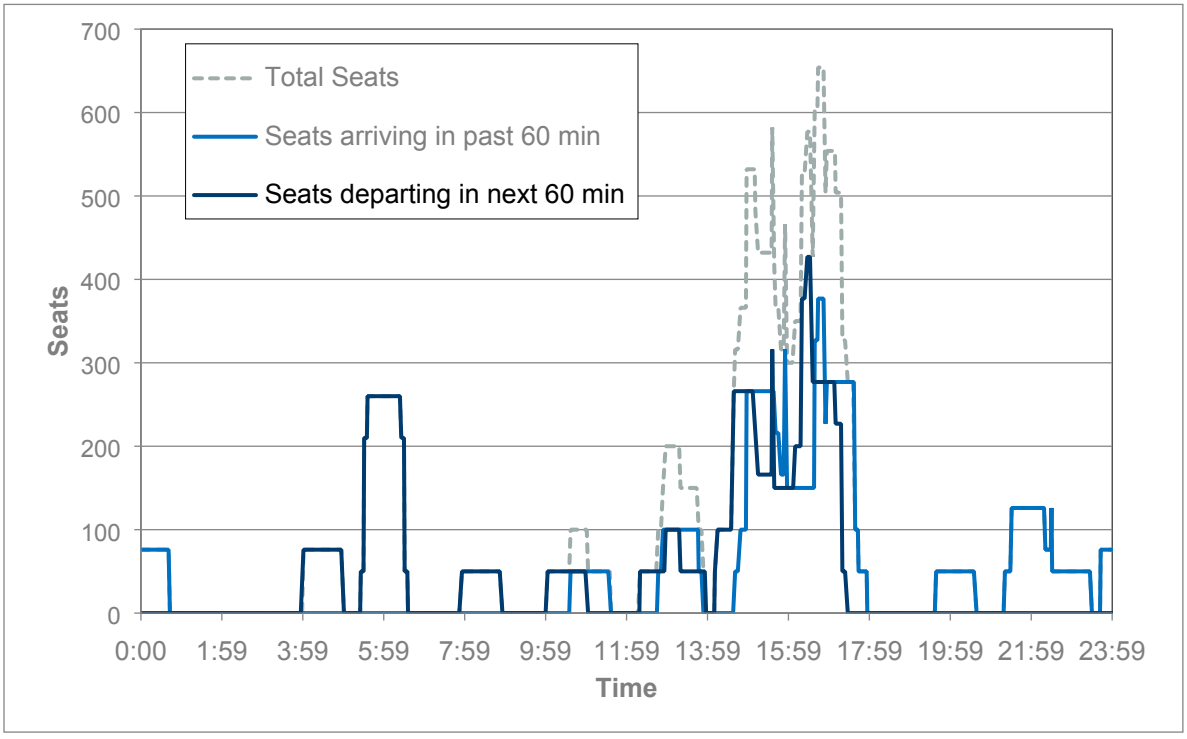
The Aircraft Approach Category (AAC) relates to aircraft approach speed and is classified by a letter (from A – E). The Airplane Design Group (ADG) component, depicted by a Roman numeral (from I – VI), relates to the aircraft's wingspan and tail height. The Taxiway Design Group (TDG) is based upon the undercarriage (i.e., wheel) spacing of the design aircraft.

December 2015 Peak Hour Passengers			
Time of Day	**Number of Seats**	**Total Daily Seats**	**Percent of Day in Peak Hour (PH)**
Enplanements (16:28 to 16:35)	427	1,229	34.7%
Deplanements (16:44 to 16:54)	377	1,145	32.9%
Total Peak Passengers (16:44 to 16:54)	**654**	**2,374**	**27.5%**

Source: Mead & Hunt, 2016

Table 2-24 Projected Peak Hour (Scheduled Carriers)					
Year	**Peak Month**		**Peak Hour Passengers**		
	Average Day Passengers		**Enplanements**	**Deplanements**	**Total Pass.**
	Enplanements	**Deplanements**	***34.7%***	***32.9%***	***27.5%***
2015	744	704	258	232	399
2020	861	815	299	268	462
2025	993	939	345	309	532
2020	1,124	1,063	391	350	603
2035	1,256	1,188	436	391	673

Source: Mead & Hunt, 2016



2.10.1 Critical Aircraft

Runway Length

The Engineering Design Report (EDR) for reconstruction of Runway 13-31 at Bismarck Airport included a detailed analysis of the critical aircraft for runway length. As this report was issued in January 2016 and accepted by the FAA, its analysis has been incorporated into this Master Plan. The EDR concluded that the most demanding aircraft for runway length is a composite of 100 percent of general aviation aircraft with maximum certificated takeoff weights of more than 12,500 pounds up to and including 60,000 pounds. This mix of aircraft have Airport Reference Codes of B-II, C-I, C-II, and D-I. Among this group, the most demanding aircraft that use Bismarck Airport are medium size business jets such as the Hawker 800, Falcon 50, and Learjet 35. The most common medium size business jet was identified based upon data tabulated from Bismarck's Instrument Flight Rule (IFR) operations recorded in the FAA Traffic Flow Management System Counts (TFMSC). Although this IFR tacking data does not include 100 percent of all aircraft operations, it represents an adequate sample for use in future planning. In 2014 and 2015, the Dassualt Falcon 50 had the highest number of TFMSC counts of all medium size business jets operating at Bismarck. As a result, the Dassualt Falcon 50 was selected as the representative medium size corporate aircraft anticipated to operate from Bismarck Airport over the 20-year planning period.

Other Runway Design and Protection Standards

A design aircraft has also been identified for runway design and protection standards. These standards include runway width, runway safety area, object free area, obstacle free zone, and runway protection zone. The critical aircraft for the remaining runway design and protection standards was identified using data tabulated from TFMSC counts for Bismarck Airport. As shown in **Table 2-25**, approximately 11,540 Category C operations, 641 Category D operations and 2,500 Design Group III operations were reported in the 2015 TFMSC. These operations included both commercial and general

aviation aircraft traffic. Nearly 80 percent of the Category C aircraft activity is attributable to commercial transport aircraft, and 20 percent to corporate jet activity. Similarly, nearly 95 percent of the Design Group III activity is attributable to commercial transport aircraft, and 5 percent to corporate jet activity.

Table 2-25 Aircraft Characteristics of Documented IFR Operations

IFR Tracked Aircraft Operations (By Functional Category)	Approach Category			Design Group			
	B	C	D	I	II	III	IV
Commercial Transports	0	9,254	606	0	7,348	2,498	14
Commercial Transports (%)	0%	80%	95%	0%	71%	100%	100%
General Aviation	1,110	2,286	35	412	3,013	6	0
General Aviation (%)	100%	20%	5%	100%	29%	0%	0%
Total IFR Tracked Operations	1,110	11,540	641	412	10,361	2,504	14
% IFR to Total Commercial Operations (57,000)	1.9%	20.2%	1.1%	0.7%	18.2%	4.4%	0.0%

Source: 2015 FAA Traffic Flow Management System Counts

Table 2-26 depicts the IFR commercial aircraft operations for years 2012 through 2015. Based on this IFR data, two series of aircraft qualify for critical aircraft selection at Bismarck Airport over the next 20-years. These include:

- Airbus 320 series (A318, A319, A320)
- Boeing MD-80 series (MD-83, MD-88, MD-90)

Both the Airbus 320 and MD-80 series aircraft exceed the FAA's threshold of 500 annual operations required for critical aircraft selection. Additionally, both aircraft types are popular narrow-body, twin-engine transport aircraft that are predominately operated by Allegiant Airlines at Bismarck. The aircraft differ in two important ways. The Airbus 320 series aircraft are categorized as Airport Reference Code C-III, while the MD-80 series is classified as D-III. Additionally, the Airbus 320 series is in TDG-3 while the MD-80 series aircraft are in TDG-4. The primary difference in TDG-3 and TDG-4 is the required width of taxiways. A detailed explanation of TDG is included in Chapter 4.0 Facility Requirements.

Table 2-26 Commercial Aircraft IFR Operations 2012-2015						
Aircraft Type	**Aircraft Model**	**ARC**	**2012**	**2013**	**2014**	**2015**
Narrow-body Transport	B752 - Boeing 757-200	D-IV	0	0	0	14
Narrow-body Transport	A318 - Airbus A318	C-III	0	2	0	0
Narrow-body Transport	A319 - Airbus A319	C-III	230	588	629	777
Narrow-body Transport	A320 - Airbus A320 All Series	C-III	210	230	256	310
Narrow-body Transport	B712 - Boeing 717-200	C-III	0	0	0	59
Narrow-body Transport	B722 - Boeing 727-200	C-III	2	0	0	0
Narrow-body Transport	B732 - Boeing 737-200/VC96	C-III	2	4	2	0
Narrow-body Transport	B734 - Boeing 737-400	C-III	0	2	0	0
Narrow-body Transport	B737 - Boeing 737-700	C-III	0	5	16	16
Narrow-body Transport	B738 - Boeing 737-800	C-III	36	38	20	38
Narrow-body Transport	B739 - Boeing 737-900	C-III	0	0	0	2
Narrow-body Transport	DC93 - Boeing (Douglas) DC 9-30	C-III	4	0	4	0
Narrow-body Transport	MD80 - Boeing (Douglas) MD 80 Series	C-III	1	1	0	0
Narrow-body Transport	MD82 - Boeing (Douglas) MD 82	C-III	9	0	0	0
Narrow-body Transport	MD83 - Boeing (Douglas) MD 83	D-III	561	551	386	385
Narrow-body Transport	MD88 - Boeing (Douglas) MD 88	D-III	141	22	66	109
Narrow-body Transport	MD90 - Boeing (Douglas) MD 90	C-III	17	5	56	98
Large Regional Jet	E170 - Embraer 170	C-III	598	688	221	247
Large Regional Jet	E190 - Embraer 190	C-III	333	60	24	20
Medium Regional Jet	CRJ7 - Bombardier CRJ-700	C-II	6	6	2	259
Medium Regional Jet	CRJ9 - Bombardier CRJ-900	D-II	209	342	974	437
Small Regional Jet	CRJ - Bombardier CRJ All Series	C-II	1	2	2	3
Small Regional Jet	CRJ1 - Bombardier CRJ-100	C-II	4	1	1	4
Small Regional Jet	CRJ2 - Bombardier CRJ-200	C-II	5,217	5,696	5,053	5,308
Small Regional Jet	E135 - Embraer ERJ 135/140/Legacy	C-II	6	130	201	337
Small Regional Jet	E145 - Embraer ERJ-145	C-II	422	14	308	1,425
Small Regional Jet	E45X - Embraer ERJ 145 EX	C-II	792	583	656	10
Small Regional Jet	J328 - Fairchild Dornier 328 Jet	C-II	0	0	2	2
		TOTAL	**8,801**	**8,970**	**8,879**	**9,860**
		Approach Category C	**7,890**	**8,055**	**7,453**	**8,915**
		Approach Category D	**911**	**915**	**1,426**	**945**
		Design Group II	**6,657**	**6,774**	**7,199**	**7,785**
		Design Group III	**2,144**	**2,196**	**1,680**	**2,061**
		Design Group IV	**0**	**0**	**0**	**14**
		Total (MD-80 Series Critical Aircraft)	**712**	**574**	**452**	**494**

Source: 2015 FAA Traffic Flow Management System Counts

It is important to consider potential changes to aircraft fleet mix over the 20-year planning period. For example, most regional airlines have indicated they will begin phasing out or supplementing the use of 50-seat aircraft over the next three to five years. At Bismarck, this trend has already begun as evident in the recent transition from 50-seat jet aircraft to larger new generation ARC C-III aircraft such as the CRJ 1000, EMB 170E2/EMB 190E2, MRJ-300, and Bombardier CS-100 Series aircraft. This pattern is also consistent with nationwide trends, as substantiated by FAA forecasts, in which the narrow-body aircraft fleet is expected to grow at a rate of 1.1 percent annually between 2014 and 2035, while the regional jet aircraft fleet is projected to decline by 1.1 percent annually during the same period. The decline in regional jet aircraft is largely attributable to the phasing out of the 50-seat regional jets.

For the purpose of planning Bismarck's future airside facility needs, the MD-80 series aircraft has been selected as the critical aircraft. The MD-80 series aircraft is expected to continue to serve Bismarck throughout the 20-year forecast period (2015-2035At some point during the 20-year forecast period it is anticipated that Allegiant will slowly begin to retire its earliest models of the MD-80 series. However, given Allegiant's operational history, it is anticipated that Bismarck Airport will continue to receive more than 500 operations by the MD-80 during the forecast period.

Fortunately, the selection of the MD-80 series aircraft as the critical aircraft for Bismarck will not impede the Airport's ability to accommodate the use of the A320 series aircraft in the future. Runway design standards are identical for ADG C-III and D-III; therefore, the applicable FAA design standards will only differ in the selection of the future TDG for the Airport. The applicable taxiway design standards for the MD-80 series aircraft is TDG-4. As a result, the A320 series aircraft, having a less stringent taxiway width requirement (TDG-3), can operate without difficulty on a wider taxiway (TDG-4). The MD-80 series

aircraft will be used as the critical aircraft throughout the development of the Bismarck Airport Master Plan.

The selection of the MD-80 series as the critical aircraft results in the use of FAA Design Standards for Airport Reference Code C-III. **Table 2-27** depicts the Airport Reference Code standards for D-III. The combination of the AAC, ADG and the Airport's approach visibility minimums form the determination of the Runway Design Code (RDC). The selection of the RDC results in the use of specific criteria needed to meet FAA design standards for runways and other airfield components. A detailed discussion about FAA design standards is included in Chapter 4.0 Facility Requirements.

Other comparable C-III transport aircraft operating at Bismarck include the Boeing 737 series, Boeing 717, Embraer 170/175, Embraer 190, and CRJ-900. Also, it should be noted that the Airport periodically experiences operations by aircraft larger than Category C and Design Group III. These larger aircraft include the Boeing 747 and Boeing C-17. Operations resulting from these larger aircraft are related to government and military operations that are associated with Bismarck state government activities and the presence of the Army National Guard base located at Bismarck Airport. The main constraint in serving these larger aircraft are the widths of the exit taxiways associated with Runway 13-31. **Table 2-28** compares the taxiway design factors for the selected critical aircraft (MD-80) and the most demanding aircraft anticipated to use the Airport throughout the 20-year planning period. However, it appears it would be prudent and cost-effective to retain wider-than-standard exit taxiways along Runway 13-31 to accommodate ADG-V operations in the future.

Table 2-27 Bismarck Airport Design Aircraft Specifications	
FAA Design Criteria	**FAA Airport Reference Code Specifications**
Primary Runway (Existing and Future)	Runway 13-31
Critical Aircraft Type	MD-80 Series (Narrowbody)
Approach Category	Category D
Design Group	Group III
Approach Speed (Knots)	141 to <166 Knots
Wingspan (feet)	79' to < 118'
Tail Height (feet)	30' to < 45'
Operator	Air Carrier

Source: FAA Advisory Circular 150/5300-13A, Change 1, *Airport Design*

Table 2-28 Taxiway Design Factors				
Factors	**Existing**		**Future**	
	Critical Aircraft	**Most Demanding Aircraft**	**Critical Aircraft**	**Most Demanding Aircraft**
Aircraft Type	MD-80 Series (Narrowbody)	Boeing 757-200 (Widebody)	MD-80 Series (Narrowbody)	Boeing 757-300 (Widebody)
Taxiway Design Group	Group 4	Group 4	Group 4	Group 4
Cockpit to Main Gear	70.5’	72.2’	70.5’	85.3’
Main Gear Width	20.3’	28.2	20.3’	28.2’
Operator	Air Carrier	Government /Military	Air Carrier	Government /Military

Source: FAA Advisory Circular 150/5300-13A, *Airport Design*

2.11 SUMMARY

Table 2-29 lists the preferred forecast alternatives that were selected. Note that for some activities, only one alternative was considered. **Table 2-30** contains a summary of the preferred Master Plan activity forecasts. These are all demand forecasts which assume that facilities will be available at Bismarck Airport to accommodate the projected activity level.

Table 2-29: Summary of Preferred Forecast Alternatives	
Activity Category	**Preferred Forecast Alternative**
Passenger Enplanements	Trend Line
Based Aircraft	Low Forecast
Operations	N/A, Single Forecast
Air Cargo	Baseline Forecast
Peak Passengers	N/A, Single Forecast

Table 2-30 Summary of Preferred Forecasts					
Category	**2015**	**2020**	**2025**	**2030**	**2035**
PASSENGER ENPLANEMENTS	**259,734**	**296,308**	**341,525**	**386,743**	**431,961**
TOTAL ANNUAL OPERATIONS	**56,709**	**58,537**	**60,987**	**63,338**	**65,598**
Itinerant Operations	41,012	42,498	43,911	45,730	47,559
Local Operations	15,697	16,039	17,076	17,608	18,039
BASED AIRCRAFT	**117**	**120**	**124**	**128**	**133**
Single-Engine Piston	65	66	67	68	70
Twin-Engine Piston	13	13	13	12	13
Turboprop	9	10	10	11	12
Jet	10	11	13	15	17
Helicopter	3	3	4	4	4
Military	17	17	17	17	17
AIR CARGO (Million Pounds)	**7.9**	**8.1**	**8.3**	**8.5**	**8.7**

Source: Mead & Hunt, 2016

2.12 FAA REVIEW TEMPLATES

Aviation forecasts are required to include two FAA-defined templates. These templates are presented in **Tables 2-31** and **2-32**.

Table 2-31 Template for Comparing Airport Planning and TAF Forecasts				
Airport Name: Bismarck Airport (BIS)				
	Year	**Airport Forecast**	**2015 TAF**	**AF vs.TAF (% Difference)**
Passenger Enplanements				
Base yr.	2015	259,734	267,147	-2.8%
Base yr. + 5yrs.	2020	296,308	288,087	2.9%
Base yr. + 10yrs.	2025	341,525	309,597	10.3%
Base yr. + 15yrs.	2030	386,743	329,589	17.3%
Commercial Operations				
Base yr.	2015	13,495	13,495	0.0%
Base yr. + 5yrs.	2020	12,884	12,610	2.2%
Base yr. + 10yrs.	2025	14,040	11,543	21.6%
Base yr. + 15yrs.	2030	15,096	12,194	23.8%
Total Operations				
Base yr.	2015	56,709	56,037	1.2%
Base yr. + 5yrs.	2020	58,537	56,033	4.5%
Base yr. + 10yrs.	2025	60,987	55,577	9.7%
Base yr. + 15yrs.	2030	63,338	56,849	11.4%
Based Aircraft				
Base yr.	2015	117	117	0%
Base yr. + 5yrs.	2020	120	124	-3.2%
Base yr. + 10yrs.	2025	124	131	-5.3%
Base yr. + 15yrs.	2030	128	136	-5.9%

Note: TAF data is based on a U.S. Government fiscal year basis (October through September).
Source: FAA 2015 Terminal Area Forecasts, Airport Forecasts (AF) complied by Mead & Hunt, 2016.
Table 2-31 Template for Comparing Airport Planning and TAF Forecasts

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Table 2-32A Summary of Bismarck Airport (BIS) Aviation Forecasts									
Operational Factors	**Aviation Forecasts**					**Compound Average Annual Growth Rates**			
	Base Yr. Level	**Base Yr. + 1yr.**	**Base Yr. + 5yrs.**	**Base Yr. + 10yrs.**	**Base Yr. + 15yrs.**	**Base yr. to +1**	**Base yr. to +5**	**Base yr. to +10**	**Base yr. to +15**
	2015	2016	2020	2025	2030	2016	2020	2025	2030
Passenger Enplanements									
Air Carrier	102,742	129,807	147,858	170,421	192,985	26.3%	7.6%	5.2%	4.3%
Commuter	156,992	130,327	148,450	171,104	193,758	-17.0%	-1.1%	0.9%	1.4%
TOTAL	259,734	260,134	296,308	341,525	386,743	0.2%	2.7%	2.8%	2.7%
Operations									
Itinerant									
Air carrier[1]	2,570	3,243	5,933	7,667	11,322	26.2%	18.2%	11.6%	10.4%
Commuter/air taxi[2]	10,925	10,130	6,951	6,373	3,774	-7.3%	-8.6%	-5.2%	-6.8%
Total Commercial Operations	13,495	13,373	12,884	14,040	15,096	-0.9%	-0.9%	0.4%	0.8%
General aviation[3]	25,131	26,259	30,772	31,450	32,472	4.5%	4.1%	2.3%	1.7%
Military	2,386	2,359	2,250	2,250	2,250	-1.1%	-1.2%	-0.6%	-0.4%
Local									
General aviation[3]	14,234	13,710	11,614	12,231	12,503	-3.7%	-4.0%	-1.5%	-0.9%
Military	1,463	1,374	1,017	1,017	1,017	-6.1%	-7.0%	-3.6%	-2.4%
TOTAL OPERATIONS	56,709	57,074	58,537	60,987	63,338	0.6%	0.6%	0.7%	0.7%
Instrument Operations	25,444	25,505	25,751	27,688	28,756	0.2%	0.2%	0.8%	0.8%
Peak Hour Operations	23	23	25	26	27	1.7%	1.7%	1.2%	1.1%
Cargo/mail (enplaned+deplaned tons)	7.9	7.9	8.1	8.3	8.5	0.5%	0.5%	0.5%	0.5%
Based Aircraft									
Single Engine (Nonjet)	67	67	68	69	71	0.0%	0.3%	0.3%	0.4%
Multi Engine (Nonjet)	20	20	20	21	21	0.0%	0.0%	0.5%	0.3%
Jet Engine	10	10	12	13	15	0.0%	3.7%	2.7%	2.7%
Helicopter	3	3	3	4	4	0.0%	0.0%	2.9%	1.9%
Other	17	17	17	171	17	0.0%	0.0%	26.0%	0.0%
TOTAL	117	118	120	124	128	0.5%	0.5%	0.6%	0.6%

Source: FAA 2015 Terminal Area Forecasts, Airport Forecasts (AF) complied by Mead & Hunt, 2016.

Notes: [1] Aircraft are considered air carrier when 60 seats or more. The anticipated transition to larger aircraft mean this category will grow as commuter aircraft become less common.

[2] Commuter/Air Taxi includes both GA on demand flights and air carrier of less than 60 seats.

[3] Totals will not reflect Table 2-14 as air taxi operations are considered separately under this table.

Table 2-32B Summary of Bismarck Airport (BIS) Aviation Forecasts					
Operational Factors	**Base Yr. Level**	**Base Yr. + 1yr.**	**Base Yr. + 5yrs.**	**Base Yr. + 10yrs.**	**Base Yr. + 15yrs.**
	2015	**2016**	**2020**	**2025**	**2030**
Average aircraft size (seats)					
Air carrier	161	161	162	163	164
Commuter	52	52	58	65	72
Average enplaning load factor					
Air carrier	80.2%	80.2%	80.2%	80.2%	80.2%
Commuter	75.9%	77.0%	80.2%	80.2%	80.2%
GA operations per based aircraft	378	378	378	377	376

Source: FAA 2015 Terminal Area Forecasts, Airport Forecasts (AF) complied by Mead & Hunt, 2016.

3.0 DEMAND CAPACITY ANALYSIS AND FACILITY REQUIREMENTS

To plan for future infrastructure improvements, an airport must conduct a facility requirements analysis to measure how well existing facilities are able to meet current and projected demand. The objective of this analysis is to determine the long-term flexibility and growth potential of existing infrastructure elements to respond to changing demand scenarios over a 20-year planning period. Those facilities unable to accommodate demand will be the focus of the alternatives analysis which will identify, review, and evaluate infrastructure improvement options to meet the needs of Bismarck Airport (BIS) users. This chapter provides a summary of the existing conditions of airside and landside facilities at the Airport and provides recommendations for facility improvements that are anticipated to be needed to meet current and future demand. The recommendations developed in this chapter provide a baseline for not only the development of alternatives, but also future Airport staffing, funding, development, and programming decisions. The recommendations from the facility requirement analysis are presented in this chapter and organized by the following sections:

3.1 Demand/Capacity Analysis
3.2 Wind Coverage
3.3 Identification of Design Standards
3.4 Runway System
3.5 Taxiway System
3.6 Aprons
3.7 Navigational Aids and Weather Equipment
3.8 Terminal Area
3.9 General Aviation Facilities
3.10 Support Facilities
3.11 Airport Traffic Control Tower
3.12 Summary of Recommendations

3.1 DEMAND/CAPACITY ANALYSIS

The purpose of the airfield demand/capacity analysis is to assess the capability of the airfield facilities to accommodate projected levels of aircraft operations. The Federal Aviation Administration (FAA) identifies two definitions of airfield capacity in FAA Advisory Circular (AC) 150/5060-5, *Airport Capacity and Delay*. The first definition of airfield capacity pertains to the maximum number of aircraft operations that a specific airfield configuration can accommodate during a period of continuous demand (i.e. an aircraft is always waiting to depart or land). This level of capacity is influenced by weather conditions, number and configuration of exit taxiways, types of aircraft that use a facility, and air traffic control/airspace handling procedures.

The second definition of airfield capacity is the number of aircraft operations that may occur during a specific time that corresponds with a tolerable aircraft delay. An important difference between these two measures of capacity is that one is defined in terms of delay, while the other is not. Among the reasons to determine delay is that each individual airfield has multiple factors that contribute to its ability to accommodate aircraft. Additionally, the relationship between demand and delay is significantly impacted by patterns of peak demand, which is also unique to an airfield.

The following airfield capacity and delay components are used in this evaluation:

Peak hour capacity – The maximum number of aircraft operations that can occur in one hour under specific operating conditions. This is also known as an airfield's maximum hourly throughput capacity.

Annual Service Volume (ASV) – Used by the FAA as an indicator of relative operating capacity, ASV is an estimate of an airport's annual capacity that accounts for differences

in runway use, aircraft mix, and weather conditions that are likely to be encountered over a one-year period. ASV assumes an acceptable level of aircraft delay as described in FAA AC 150/5060-5, *Airport Capacity and Delay*.

3.1.1 Factors Affecting Runway Capacity

A number of factors can impact airfield capacity and delay, including:

- Airfield layout and runway configuration
- Number and location of exit taxiways
- Runway use restrictions
- Runway use as dictated by wind conditions
- The percentage of time the airport experiences poor weather conditions
- The level of touch-and-go activity
- Types of aircraft that operate at the airport
- Surrounding terrain/local geography
- Changes in air traffic control procedures

3.1.2 Weather Conditions

Weather conditions can impact an airport's capacity by causing conditions that require the facility to close or slow down aircraft operations. There are two categories for weather conditions related to operating aircraft, instrument meteorological conditions (IMC) and visual meteorological conditions (VMC). VMC weather conditions exist when the cloud ceiling is 1,000 feet or greater and visibility is three statute miles or greater. IMC conditions are those below the stated VMC minimums.

It is important to differentiate IMC and VMC conditions because greater separation distances are required between aircraft under IMC conditions. According to the wind and weather analysis in the following sections, VMC conditions occur approximately 91.5 percent of the time, and IMC conditions occur approximately 8.5 percent of the time.

3.1.3 Touch-and-Go Operations

Touch-and-go operations are defined as those conducted by a single aircraft that lands and departs on a runway without taxiing. Such operations are typically associated with training or proficiency exercises. Typically, airfield capacity increases with the ratio of touch-and-go operations as aircraft are within the local traffic pattern and available for approaches. According to Airport Traffic Control Tower (ATCT) records, touch-and-go operations account for about 22 percent of all operations at BIS.

3.1.4 Identification of Design Standards

The size and type of aircraft that operate at an airport have a significant impact on airfield capacity. As shown in **Table 3-1**, aircraft are categorized according to their individual size and approach speed.

Table 3-1. Aircraft Classifications

Aircraft Classification	Take-off Weight (pounds)	Types of Aircraft	Estimated Approach Speed (knots)
A	12,500 or less	Small single engine aircraft	80
B	12,500 or less	Small multi-engine aircraft	110
C	12,500-300,000	Large aircraft	130
D	300,000 or more	Heavy aircraft	150

Source: FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*.

The classifications shown in the table above form the basis for the Mix Index, which is a mathematical expression utilized in airfield capacity analysis. The Mix Index is the percent of Class C aircraft plus three times the percent of Class D aircraft. Utilizing operational fleet mix projections presented in Chapter Two, Aviation Activity Forecasts, the mix index is estimated to be 28 percent during VMC conditions and 61 percent during IMC conditions. Peaking characteristics from the aviation forecast chapter are used to identify design hour demand at the Airport.

3.1.5 Peak Hour Capacity

Peak hour capacity is defined as the measure of the maximum number of aircraft operations that can be completed on a runway system in one hour. This calculation incorporates runway use configuration, dimensional spacing criteria, fleet mix, touch and go activity, and runway exit factor. Utilizing guidelines contained within the FAA AC 150/5060-5, Airport Capacity and Delay, the capacities for the airport's primary operating configurations were determined. There are two primary configurations available at BIS, these include the simultaneous use of two intersecting runways, and the use of only a single runway. **Table 3-2** summarizes the hourly capacities of these two primary configurations for both VMC and IMC weather conditions. Although instrument approaches exist for all four runway ends at BIS, simultaneous use of the intersecting runways generally does not occur during IMC conditions.

Table 3-2. Peak Hour Airfield Capacity

Airfield Configuration	Weather Conditions	Hourly Capacity
Simultaneous Use of Intersecting Runways	VMC	77
	IMC	n/a
Single Runway In Use	VMC	63
	IMC	56

Source: FAA Advisory Circular 150/5060-5 *Airport Capacity and Delay*, Mead & Hunt

Existing and projected peak hour operational demand was presented in Chapter Two. Demand ranged from 22 peak hour operations in 2015 to a projected demand for 28 peak hour operations in 2035. Therefore, given the capacities identified above, the existing configuration of the airfield is anticipated to satisfy projected peak hour demands throughout the 20-year planning period.

3.1.6 Annual Service Volume

ASV is a reasonable estimate of an airport's annual practical capacity. It accounts for differences in runway use, aircraft mix, weather conditions, pattern of demand (peaking),

and other factors that impact capacity at an airport. The formula for calculating ASV contains three variables that are multiplied to obtain the ASV for the Airport:

$$ASV = Cw * D * H$$

Weighted hourly capacity (Cw), as calculated from the above hourly capacities and in accordance with FAA AC 150/5060-5, *Airport Capacity and Delay*, was found to be 63 operations per hour.

The Daily Demand Ratio (D) is the ratio of annual demand to average daily demand in the peak month (December). As described in Chapter Two, the number of Peak Month Average Day (PMAD) operations in 2015 was 201. The ratio of annual demand (56,721 total operations) to the average daily demand (231 operations) results in a D value of 283.

The Hourly Demand Ratio (H) is the ratio of average daily demand to average peak hour demand during the peak month. As was noted in Chapter Two, the number of peak hour operations was estimated at 25. The ratio of average daily demand (201) to peak hour demand (25) results in an H value of 8.02.

As a result of the identified values for the variables, ASV for BIS is defined as follows:

$$ASV = Cw* D * H$$

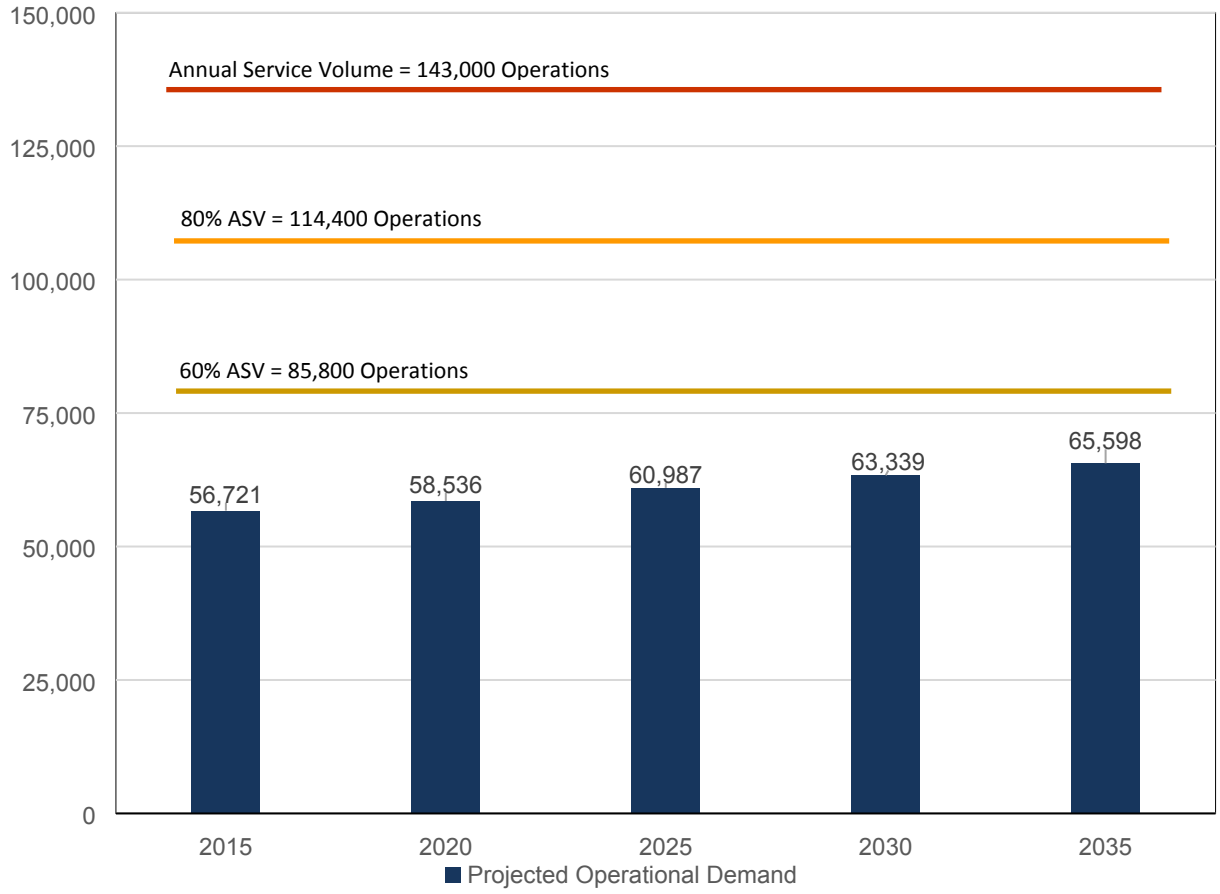
$$ASV = 63 * 283 * 8.02$$

$$ASV = 143{,}000 \text{ operations (rounded)}$$

FAA Order 5090.3C, Field Formulation of the National Plan of Integrated Airport Systems (NPIAS) recommends that when an airport's annual operations reach 60 percent of its ASV, additional airfield facilities to increase capacity should be planned. This threshold is

set low to allow time to complete a thorough investigation of alternatives and required environmental evaluations. When annual operations reach 80 percent ASV, new airport facilities should be programmed, or demand management strategies should be implemented. This is also meant to provide adequate time for planning and project implementation before demand exceeds capacity. **Exhibit 3-1** presents the projected number of total airport operations and the ASV capacity thresholds.

Exhibit 3-1 Operational Demand and Annual Service Volume



As shown above, operations at BIS are projected to remain below the 60 percent capacity planning threshold through the planning period. Therefore, the need for an additional runway to provide additional capacity is not anticipated within the 20-year planning period.

3.2 WIND COVERAGE

Airport runway layouts are typically aligned to an area's prevailing winds. Historical wind data is compiled and sorted into direction and velocity. The periodic reports that are most frequent are the ones that should determine the preferred configuration of the runway. The FAA recommends that the primary runway offer 95 percent coverage of all-weather wind conditions. Whether this is possible is based upon the type of aircraft that frequent the airfield. Due to the fact that smaller aircraft are more susceptible to crosswinds, the larger the aircraft, the larger the crosswind component that is used for a specified runway.

In evaluating wind coverage at an airport, FAA guidance notes this assessment be computed on a basis that crosswinds not exceed the maximum allowable velocities for the following aircraft categories:

- 10.5 knots for Airport Reference Code A-I and B-I aircraft
- 13 knots for Airport Reference Code A-II and B-II aircraft
- 16 knots for Airport Reference Code A-III, B-III, and C-I through D-III aircraft
- 20 knots for Airport Reference Code A-IV through D-VI aircraft

Data for BIS was taken from the on-site Automated Surface Observing System (ASOS) and includes the last 10 years of hourly observations. After sorting and analyzing this information, it was noted that the primary Runway 13/31 has an all-weather coverage of 92.85 percent at 10.5 knots. As **Table 3-3** shows, the primary runway alone does not have sufficient crosswind coverage for small aircraft. This shortfall requires a crosswind runway to service those aircraft that apply to the 10.5 knot crosswind component. With

the addition of the crosswind runway, combined wind coverages are above the 95 percent threshold for all three weather variables including all weather, VFR, and IFR as well as all four aircraft crosswind categories.

Table 3-3. BIS Wind Coverage							
Crosswind Component	**Rwy 13**	**Rwy 13/31**	**Rwy 31**	**Rwy 3**	**Rwy 3/21**	**Rwy 21**	**Combined 13/31 & 03/21**
All Weather Conditions							
10.5 knots	59.02%	92.85%	67.16%	65.19%	79.48%	54.92%	97.86%
13 knots	61.11%	96.47%	69.22%	70.47%	86.88%	58.91%	99.42%
16 knots	62.75%	99.00%	70.76%	75.78%	94.15%	63.08%	99.89%
20 knots	63.25%	99.78%	71.27%	78.81%	98.16%	65.10%	99.99%
Visual Flight Rules (VFR)							
10.5 knots	58.73%	93.53%	68.14%	64.34%	79.56%	56.32%	98.10%
13 knots	60.70%	96.90%	70.04%	69.47%	86.99%	60.57%	99.51%
16 knots	62.17%	99.17%	71.42%	74.68%	94.33%	65.01%	99.90%
20 knots	62.57%	99.83%	71.85%	77.56%	98.30%	67.19%	99.99%
Instrument Flight Rules (IFR)							
10.5 knots	61.36%	89.04%	61.57%	70.53%	79.50%	47.67%	96.57%
13 knots	64.18%	93.92%	64.51%	76.36%	86.46%	50.16%	98.93%
16 knots	66.83%	97.91%	66.91%	82.06%	93.22%	52.80%	99.84%
20 knots	67.90%	99.50%	67.93%	85.87%	97.47%	53.96%	99.97%

Note: Single runway end coverage calculated with a three-knot tailwind

Source: FAA AGIS wind analysis tool

Period of Record: 2005-2015 based on 107,173 observations

VFR = Ceiling greater than or equal to 1,000 feet and visibility greater than or equal to three statute miles

Table 3-4 depicts the true bearing for the primary and crosswind runways at BIS. True bearings represent the actual latitudinal and longitudinal coordinates for each runway end. This information is used in the calculation of wind coverage depicted in Table 3-3.

Table 3-4. True Bearing Calculation				
	Runway 13	**Runway 31**	**Runway 3**	**Runway 21**
Latitude	46-47-02.2295 N	46-45-58.1454 N	46-45-45.4201 N	46-46-36.0191 N
Longitude	100-45-42.4312 W	100-44-17.231 W	100-44-54.2937 W	100-43-54.5867 W
True Bearing	137.6725	317.6897	38.9400	218.9519

Source of Coordinates: Federal Aviation Administration National Flight Data Center database
Calculated using NOAA NGS inverse computation model, NAD83 ellipsoid

Table 3-5 identifies the magnetic declination of each runway end at BIS. Magnetic declination represents the angle on the horizontal plane between magnetic north and true north. Calculating magnetic declination is necessary to determine the runway end numbers at BIS remain the same over the 20-year planning period. As shown in the table below, the magnetic declination calculation for both runways at BIS will remain unchanged; therefore, the runway end identification numbers remain current and meet FAA guidelines.

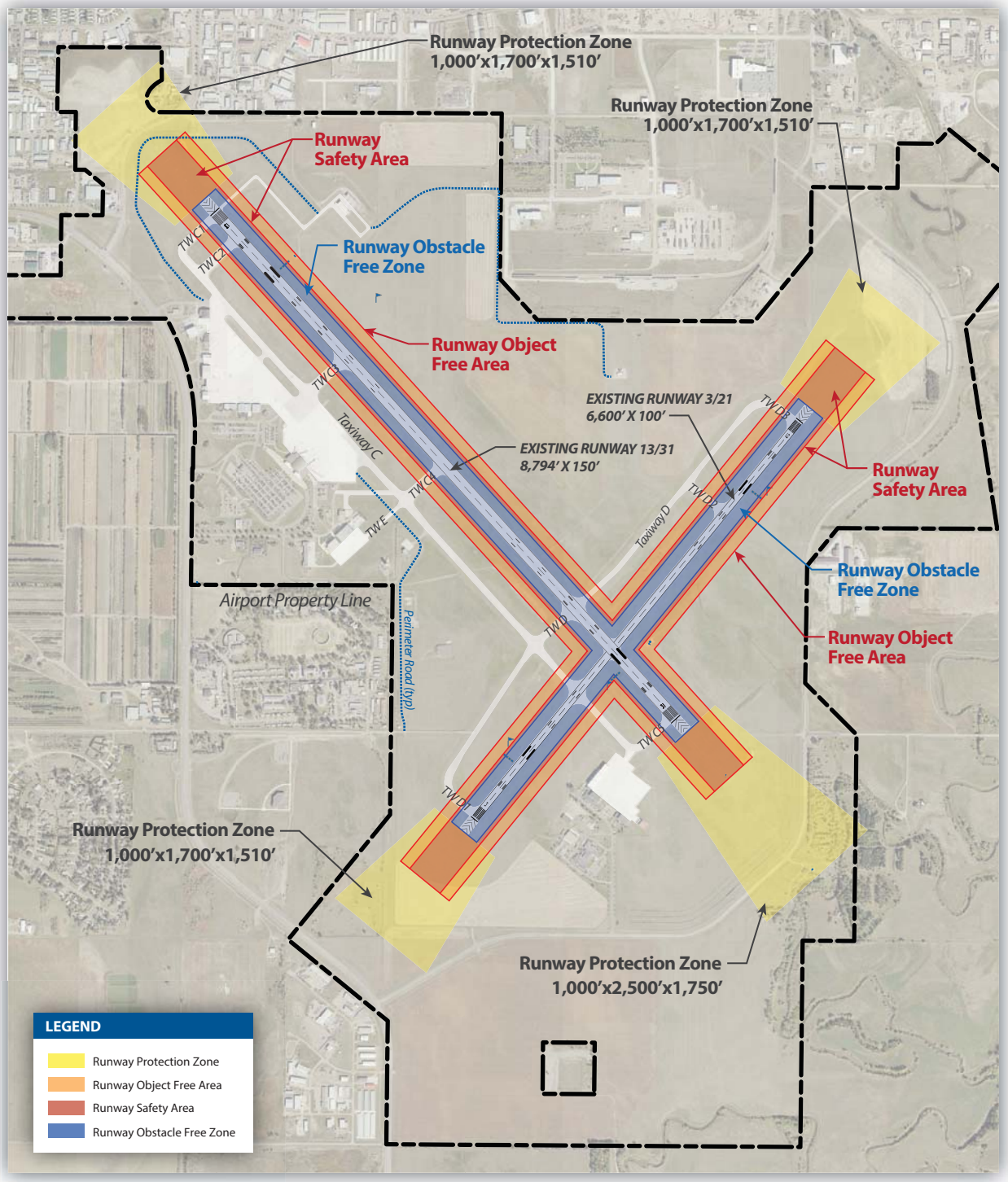
Table 3-5. Magnetic Declination Calculation				
	Runway 13	**Runway 31**	**Runway 3**	**Runway 21**
True Bearing	137.6725	317.6897	38.9400	218.9519
Declination	6° 5’ E	6° 5’ E	6° 5’ E	6° 5’ E
Magnetic Bearing	131.5892	311.6064	32.8567	212.8686
Runway Designation	13	31	3	21

Note: Magnetic declination calculated for October 31, 2016, using World Magnetic Model (WMM)

3.3 IDENTIFICATION OF DESIGN STANDARDS

The design of airport infrastructure such as runways, taxiways, and aprons is based on design standards established by the FAA. FAA AC 150/5300-13A, *Airport Design*, categorizes design standards that relate to airport infrastructure components based on a variety of factors including the approach speed, wingspan, and undercarriage dimensions of an aircraft. The following describes the two coding systems identified in FAA AC 150/5300-13A, *Airport Design*, that are used in the design and planning of airfield

surfaces. **Exhibit 3-2** and **Table 3-6** show the various safety areas and dimensions associated with the RDC.



Bismarck AIRPORT Master Plan Update

Exhibit 3-2 **Runway Surfaces**

Table 3-6: Runway Design Standards				
Criteria	13/31		03/21	
	Existing	Standard	Existing	Standard
Design				
Runway Width	150	150	100	100
Shoulder Width	25	25	20	20
Blast Pad length	200	200	200	200
Blast Pad Width	150	200	140	140
RSA				
Length	1,000	1,000	1,000	1,000
Width	500	500	500	500
ROFA				
Length	1,000	1,000	1,000	1,000
Width	800	800	800	800
ROFZ				
Length	200	200	200	200
Width	400	400	400	400
RPZ	**31**		**03**	
Length	2,500	2,500	1,700	1,700
Inner Width	1,000100	1,000100	1,000	1,000
Outer Width	1,750	1,750	1,510	1,510
RPZ	**13**		**21**	
Length	1,700	1,700	1,700	1,700
Inner Width	1,000	1,000	500	500
Outer Width	1,510	1,510	1,010	1,010
Approach Slope				
Width Beginning	1,000	1,000	1,000	1,000
Width Ending	4,000	4,000	4,000	4,000
Length	10,000	10,000	10,000	10,000
Slope	5030:1	5030:1	34:1	34:1
Departure Slope				
Width Beginning	1,000	1,000	1,000	1,000
Width Ending	6,466	6,466	6,466	6,466
Length	10,200	10,200	10,200	10,200
Slope	40:1	40:1	40:1	40:1

Source: FAA Threshold Siting Surface (TSS)

3.3.1 Runway Design Code

As many of the aircraft restrictions for airport facilities are based on the operating criteria of a given aircraft, it is first necessary to establish how aircraft are categorized. These categorizations will be used throughout this section when discussing existing restrictions and further expounded upon later in this chapter when incorporating the use of the critical aircraft identified in Chapter Two. In order to identify the appropriate design parameters for a runway and many associated facilities, aircraft are categorized by their Runway Design Code (RDC). The RDC uses the approach speed, wingspan, and tail heights of relevant aircraft. Current RDCs for both runways are identified in this section as well as the recommended future RDCs for each runway over the 20-year planning period.

The RDC is broken into separate parts: the Aircraft Approach Category (AAC), the Aircraft Design Group (ADG) and the Runway Visual Range (RVR). The AAC is designated by a letter that corresponds to the approach speed of an aircraft. AAC categories are shown by the relevant approach speeds identified in **Table 3-7**. The second component, the ADG, is represented by a Roman numeral dependent on the aircraft tail height and wingspan width. When there is a conflict between the tail height and the wingspan, the greater, or more restrictive, group identifier is used. Specific ADG dimensions can be seen in **Table 3-8**. According to the 2007 ALP, the Runway 13/31 RDC is D-IV while the Runway 3/21 RDC is C-III. It is important to note that these designations were based on the selection of a critical aircraft during the previous airport master plan. For the purposes of this analysis, the selection of the future RDCs for both runways is based on the critical aircraft identified in Chapter Two as well as the projected fleet mix anticipated to operate at BIS throughout the planning period. The sections below provide a detailed description of the RDCs recommended through 2035.

Table 3-7. Aircraft Approach Category (AAC)	
AAC	**Vref / Approach Speed**
A	Approach speed less than 91 knots
B	Approach speed 91 knots of more but less than 121 knots
C	Approach speed 121 knots or more but less than 141 knots
D	Approach speed 141 knots or more but less than 166 knots
E	Approach speed 166 knots or more

Source: FAA Advisory Circular 150/5300-13A, *Airport Design*

Table 3-8: Airplane Design Groups (ADG)		
Group	**Tail Height**	**Wingspan**
I	Less than 20 feet	Less than 49 feet
II	20 feet to less than 30 feet	49 feet to less than 79 feet
III	30 feet to less than 45 feet	79 feet to less than 118 feet
IV	45 feet to less than 60 feet	118 feet to less than 171 feet
V	60 feet to less than 66 feet	171 feet to less than 214 feet
VI	66 feet to less than 80 feet	214 feet to less than 262 feet

Source: FAA Advisory Circular 150/5300-13A, *Airport Design*

The third and final component of the RDC, the RVR, relates to the visibility minimums of an approach to a runway. Visibility restrictions often help determine the width of the pavement and the dimensions of protection surfaces. The RVR is a description of visibility minimums as defined by FAA AC 150/5300-13A, *Airport Design*, and is used in conjunction with the AAC and ADG to determine the dimensions of runway design surfaces. The RVR for each runway is shown below in **Table 3-9**.

Table 3-9: BIS Instrument Approaches			
Approach	**Visibility**	**Ceiling Limit**	**RVR**
ILS or LOC RWY 13	3/4	200	N/A
ILS or LOC RWY 31	1/2	200	2400
RNAV (GPS) RWY 13	3/4	200	N/A
RNAV (GPS) RWY 31	1/2	200	–*
RNAV (GPS) RWY 3	3/4	200	N/A
RNAV (GPS) RWY 21	3/4	250	N/A
VOR-A	1	579	N/A
ASR 31	½	500	2400
ASR 13	1	500	N/A
ASR 03	1	500	N/A
ASR 21	1	500	N/A

Note: *As these are not the most restrictive approaches, an RVR was not assigned.
ASR: Surveillance Approach Radar
All ASR approaches are given for category A.
Source: FAA Digital Terminal Enroute Procedures, 2016.

Runway 13/31 RDC

The most prominent aircraft is the CRJ 200, which comprised 52 percent of commercial aircraft in 2015, based on information obtained from the U.S. Department of Transportation's T100 Database. While the CRJ 200 is capable of slightly faster approach speeds, it generally operates within the range of 121 knots and 141 knots and has a wingspan between 49 and 79 feet. As a result, this aircraft can be described as primarily a C-II aircraft. A sample of Runway 13/31 commercial aircraft activity for year 2015 is shown in **Table 3-10** and is ranked in descending order of annual operations.

The critical aircraft factoring into runway design, particularly at busy airports, is not necessarily a single aircraft, but can be a conglomeration of the most demanding aircraft

at an airport. The most demanding aircraft currently operating at BIS is the MD-83. Therefore, the RDC for Runway 13/31 for the duration of the planning period is D-III.

Table 3-10: RDC for Selected Aircraft of Runway 13/31

Aircraft Type	2015 Operations	Seating Capacity	Runway Design Code	Approach Speed (knots)	Wingspan (feet)	Tail Height (feet)
Bombardier CRJ200	5,312	50	C-II	135	69	20
Embraer 145	1,424	50	C-II	135	65	22
Airbus A319	780	128	C-III	138	112	40
MD 83	472	163	D-III	144	108	30
Bombardier CRJ900	436	86	C-III	141	81	24
Airbus A320	310	150	C-III	138	111	39
Bombardier CRJ700	262	70	C-II	137	76	24
Embraer 170	200	78	C-III	124	85	32
MD 90	98	160	C-III	138	108	31
Boeing 717-200	58	134	C-III	125	93	30
Embraer 175	44	86	C-III	124	85	31
Boeing 737-800	32	175	C-III	140	94	37
Boeing 757-200	14	180	C-IV	137	125	45
Embraer 190	12	100	C-III	124	94	35
Boeing 737-700	6	143	C-III	130	113	42

Source: BIS Airport Records, Aircraft Planning Manuals, AC 150/5300-13A *Airport Design*

Runway 3/21 RDC

At BIS, air carriers typically operate from Runway 13/31 in order to immediately access the passenger terminal and conserve fuel. General Aviation (GA) aircraft operate on both runways; however, they typically utilize Runway 3/21. As depicted in **Table 3-11**, Traffic Flow Management System Counts (TFMSC) data was used to determine the number of GA turbine aircraft operations occurring on Runway 3/21 during 2015. However, TFMSC

only records activity as filed under instrument flight plans, therefore this does not reflect all operations at BIS. Although the most demanding GA aircraft is the Gulfstream IV, air carriers such as the A319 also use Runway 3/21 when crosswinds or traffic prohibit use of the primary runway. Therefore, based on existing use of the crosswind runway by air carriers and on Airport interviews, the RDC for Runway 3/21 is C-II. In addition, the crosswind runway will be able to serve air carrier traffic during the upcoming Runway 13/31 reconstruction project.

Table 3-11: RDC for Selected Aircraft of Runway 3/21

Aircraft Type	2015 Operations	Runway Design Code	Approach Speed	Wingspan	Tail Height
Existing Aircraft					
Beech 1900/C-12J	2,031	B-II	113	55	15
Cessna Encore	1,099	B-II	107	56	17
Airbus A319	780	C-III	138	112	40
Falcon 50	222	B-II	107	61	22
Cessna Citation CJ4	203	B-II	100	51	15
Embraer 170	200	C-III	124	85	32
Cessna Bravo	163	B-II	108	52	15
Hawker 800	111	C-I	128	51	18
Gulf Stream 280	50	B-II	108	63	21
Bombardier Learjet 60	40	C-I	132	43	14
Gulfstream IV/G400	25	C-II	128	77	24

Source: Aircraft Planning Manuals, AC 150/5300-13A *Airport Design*

Note: As runway specific information is not available total operations are shown

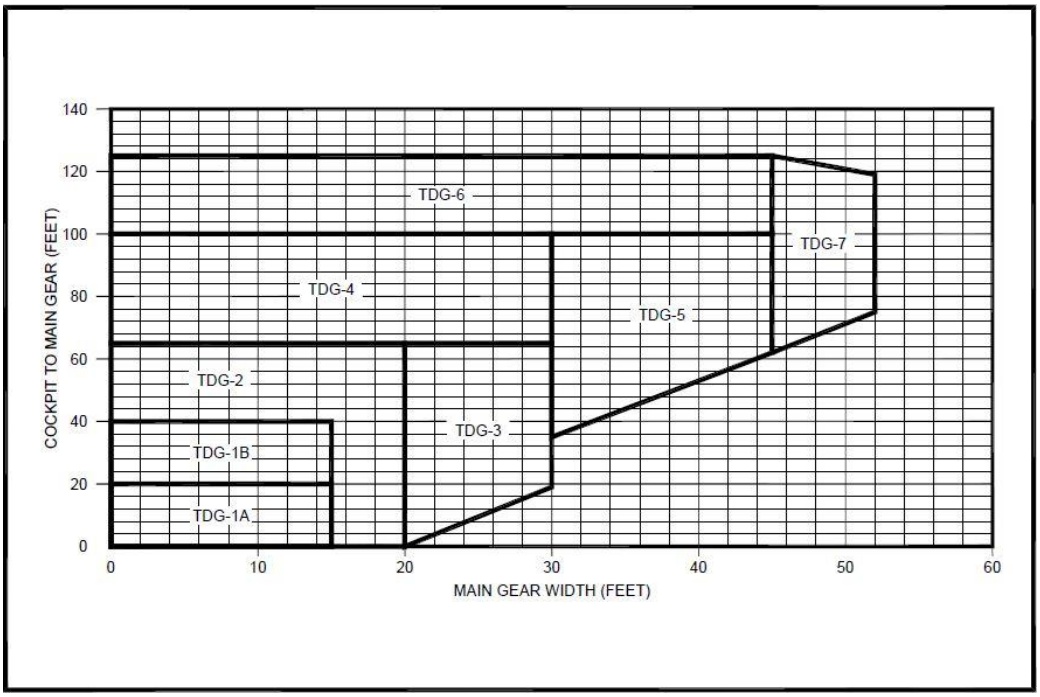
3.3.2 Taxiway Design Group

In September 2012, Advisory Circular 150/5300-13A, *Airport Design*, was published, which includes updated guidance for taxiway design. Similar in determination to RDC,

taxiway design is based on the combination of the taxiway design group (TDG) and ADG classification of the critical design aircraft intended to operate on the taxiway in question. The TDG classification determines the physical pavement dimensions of a taxiway, while the ADG classification determines required taxiway separations and the width of the taxiway safety area and taxiway object free area (TOFA).

Historically, taxiway pavement dimensions were designed based on the ADG of the critical aircraft. The updated guidance instead uses a TDG based upon the overall Main Gear Width (MGW) and the Cockpit to Main Gear Distance (CMG) of the critical design aircraft landing gear (see **Exhibit 3-3** for limitations). Based on the dimensions of the CRJ200, the TDG for this aircraft is TDG-1B while the MD-83 is TDG-4. Additional aircraft within the fleet (**Table 3-12**) are discussed in greater detail in a following section.

Exhibit 3-3 Taxiway Design Groups



Source: FAA AC 150/5300-13A, *Airport Design*

Table 3-12 TDG for Selected Aircraft					
Aircraft Type	**2015 Operations**	**Seating Capacity**	**Taxiway Design Code**	**Cockpit to Main Gear**	**Main Gear Width**
Bombardier CRJ200	5,312	50	TDG-1B	37 feet	13 feet
Embraer 145	1,424	50	TDG-2	47 feet	14 feet
Airbus A319	780	128	TDG-3	45 feet	29 feet
MD 83	472	163	TDG-4	71 feet	20 feet
Bombardier CRJ900	436	86	TDG-3	56 feet	17 feet
Airbus A320	310	150	TDG-3	50 feet	29 feet
Bombardier CRJ700	262	70	TDG-3	48 feet	17 feet
Embraer 170	200	78	TDG-3	38 feet	17 feet
MD 90	98	160	TDG-4	77 feet	18 feet
Boeing 717-200	58	134	TDG-3	56 feet	20 feet
Embraer 175	44	86	TDG-3	40 feet	19 feet
Boeing 737-800	32	175	TDG-3	56 feet	23 feet
Boeing 757-200	14	180	TDG-4	72 feet	28 feet
Embraer 190	12	100	TDG-3	47 feet	21 feet
Boeing 737-700	6	143	TDG-3	47 feet	23 feet

Source: Aircraft Planning Manuals, AC 150/5300-13A *Airport Design*

3.4 RUNWAY SYSTEM

There are two intersecting runways at BIS. The primary runway, Runway 13/31, is 8,794 feet long and 150 feet wide. The crosswind runway, Runway 3/21, is 6,600 feet long and 100 feet wide. This section will discuss the various aspects of the runways and their ability to meet the current and anticipated design aircraft.

3.4.1 Runway Length

Runway lengths are determined based on the specific performance characteristics of aircraft intended to use the airport. Determining variables for runway length include the

mean daily maximum temperature of the hottest month of the year, and the airport elevation. Both parameters influence air density. Air density directly impacts aircraft performance through two principles. First, the thrust generated by propeller or jet engines will be less effective at higher temperatures and elevations, as the thinner air will not produce as much forward momentum in the aircraft. Second, the air moving over the wing will not generate as much lift and greater speeds are required to generate the same amount of lift as at lower temperatures and elevations. These two principles compound to exponentially increase an aircraft's takeoff distances as temperature and elevation increase.

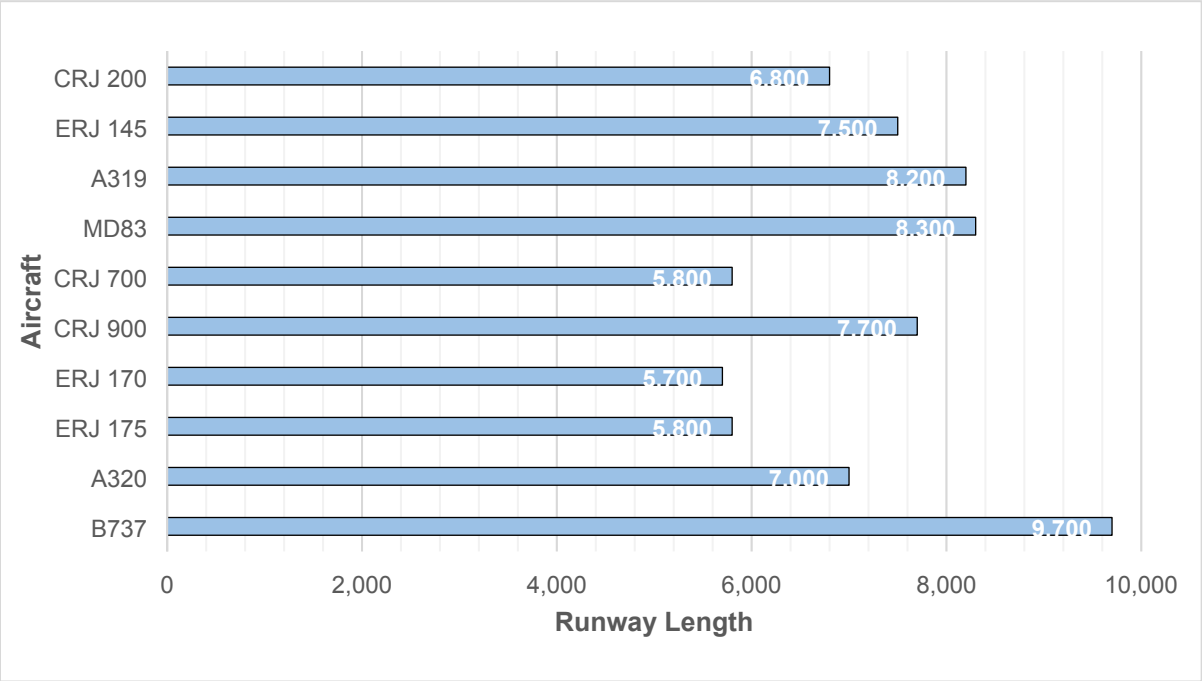
The length of a runway can accommodate the landing and takeoff distance requirements of the most demanding types of aircraft conducting regular operations. The length necessary is therefore dependent on aircraft performance and FAA AC 150/5325-4B, *Runway Length Requirements for Airport Design*, provides guidance on how the necessary length of the runway is to be derived based on aircraft performance. Based on this guidance the airport temperature parameter should be set equal to the mean daily maximum temperature of the hottest month at the airport. According to the National Oceanic and Atmospheric Administration (NOAA), the mean daily maximum temperature of the hottest month from 2011 to 2015 at BIS was 85.2°F, which occurred in July. The Airport elevation is 1,661 feet above sea level according to the latest FAA Airport/Facility Directory. This data was used to determine the runway length required for the critical aircraft at BIS.

Runway 13/31

The aircraft currently operating on the airport, or which may be prevalent in the future, have been discussed in Section 3.3. Required runway lengths for each air carrier aircraft at maximum takeoff weight in the conditions specific to BIS, described above, are shown

below in **Exhibit 3-4**. As the upcoming runway reconstruction project will correct the existing runway grades, the existing grading was not considered when determining runway length. As Runway 13/31 is the primary runway and intended to serve air carriers, it is important to consider how many aircraft are able to operate on these runways. Runway 13/31 is 8,794 feet long and able to serve the majority of aircraft at their maximum takeoff weight either currently operating or expected to operate at BIS. The Boeing 737-800 is not able to takeoff at its maximum takeoff weight at the current runway length. This means that this aircraft must either reduce fuel on board, which would also reduce potential service range and markets, or the number of passengers and/or cargo that they carry.

Exhibit 3-4: Runway Length Requirements

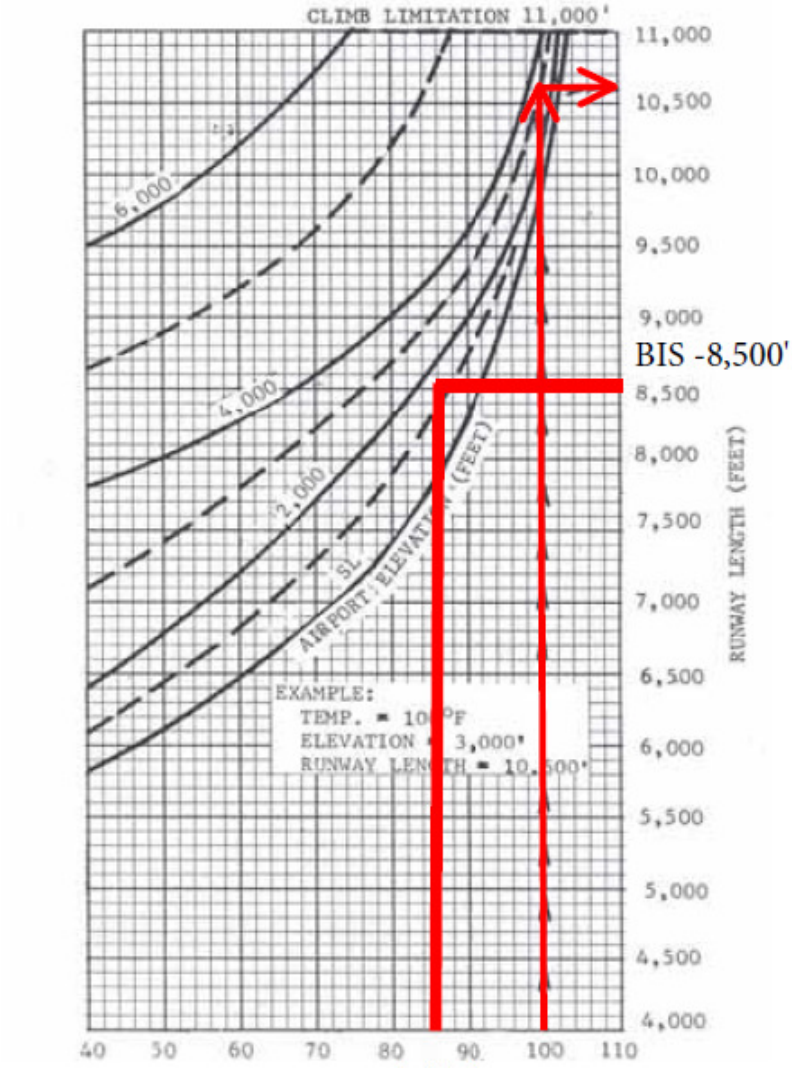


The Runway 13/31 length analysis conducted as part of the 2016 Engineering Design Report (EDR) stated that the most demanding aircraft currently operating at the Airport is the MD83 flying to various Allegiant markets, such as Las Vegas, Phoenix, and Orlando. Of these destinations, Orlando would be the most demanding, requiring a runway length of 8,100 feet. That flight is currently served by an A319 although Allegiant has a substantial fleet of MD83s and, in 2014, used the MD83s to service Orlando from BIS 11 times. When determining runway requirements for corporate aircraft, a calculation for 100 percent of the fleet at a 90 percent useful load supported the need for a length of at least 8,500 feet, as shown in **Exhibit 3-5**. When grade changes in the runway are considered as well, this brings the total required runway length to 8,600 feet. Shortening the runway to this length was estimated approximately $1 million more expensive that reconstruction at its current length due to shifting the associated NAVAIDS (i.e. PAPI, MALS), ILS approach equipment and any additional FAA costs and time for development of new approaches. Therefore, the current length of 8,794 feet is the recommended length for the duration of the 20-year planning period.

Runway 3/21

Runway 3/21 is the crosswind runway at BIS. Therefore, it tends to serve GA aircraft and air carrier traffic when crosswind conditions are not favorable or when Runway 13/31 is occupied. Since the growth of oil development in the western half of North Dakota in 2010, GA activity of aircraft weighing between 12,500 – 60,000 pounds has increased considerably. The 2015 Engineering Design Report (EDR) stated that in 2013, 1,800 operations occurred in this category while in 2014, activity increased to 2,100 operations. A 90 percent useful load is used in the analysis for runway length due to the range and onboard fuel of the jets. A summary of these jets based at BIS are shown below in **Table 3-13**.

Exhibit 3-5: EDR Runway Length Requirement



Source: 2016 EDR, AC 150/5325-4B, *Runway Length*

Table 3-13: Based Jet Operations				
Company	**Aircraft**	**Typical Stage Length**	**Flights at or above 90% Useful Load**	**RDC**
Basin Electric	2 Cessna Encores	500 – 600 miles	40%	B-II
MDU	Cessna Encore	500 – 600 miles	75%	B-II
	Cessna Bravo	600 – 700 miles		B-II
Rocket Man	Falcon 50	600 – 700 miles	60%	B-II
	Beech Jet	600 – 700 miles		C-I
MBI Leasing	Gulf Stream 280	+ 1,000 miles	60% – 70%	B-II
	Cessna Citation CJ4	+ 1,000 miles		B-II

Source: Bismarck Airport Records, Mead & Hunt, 2016

The current length of Runway 3/21 is able to serve most aircraft. The Beechjet 1900 and Gulfstream IV are not able to depart at maximum takeoff weight (MTOW). While the Beechjet is a common aircraft at BIS (in 2015 it conducted at least 2,031 operations) its limitation is not thought to affect normal operations. The Gulfstream IV does not operate with enough frequency to justify a longer runway length at this time. Therefore, Runway 3/21 is of sufficient length for the duration of the planning period.

3.4.2 Runway Width

Although the length of a runway is based on the specific operating needs of the critical aircraft, the width of a runway is based directly on its RDC. However, in addition to the width of the runway itself, the width of the shoulders of the runways and the attached blast pads should also be considered. The shoulder and blast pads of a runway protect the surrounding earth from erosion due to jet and prop wash while also supporting maintenance and emergency vehicles. Although neither runway at BIS has paved shoulders, they are required for runways accommodating ADG IV and higher and are recommended for runways accommodating ADG III aircraft. The required width for each

of these aspects of the runway are shown in **Table 3-14**. In summary, Runway 13/31 lacking paved shoulders and the width of the blast pads are 150 feet and do not meet existing standards. While Runway 3/21 does not have paved shoulders, it does not require them as it is not intended to serve ADG IV aircraft. Additionally, the width of blast pads for Runway 13/31 will be increased to achieve compliance with current FAA requirements as part of the Runway 13/31 reconstruction project.

Table 3-14: Runway Width Requirements

Runway	RDC	Runway Width	Shoulder Width	Blast Pad Width
Runway 13/31	D-III	150 feet	***25 feet***	***200 feet***
Runway 3/21	C-II	100 feet	20 feet	140 feet

Source: FAA AC 150/5300-13A, *Airport Design*

Note: Bold italicized text may note a discrepancy between FAA Standards and actual runway measurements

3.4.3 Runway Grade

Runway gradient design standards are outlined in FAA AC 150/5300-13A, *Airport Design*, so that pilots and air traffic controllers can view that any one point on a runway is clear of aircraft, vehicles, wildlife, and other objects. Design standards for longitudinal and transverse runway grades are based on the AAC of the critical design aircraft. Gradient standards are the same for AAC category C, D, and E aircraft with the maximum allowable longitudinal grade change between runway ends being ±1.50 percent; it should be noted that the longitudinal grade may not exceed ±0.80 percent in the first and last quarter of a runway. Although there are grading concerns, the current line of sight for the runways are sufficient and will be maintained during the implementation of the Runway 13/31 rehabilitation project.

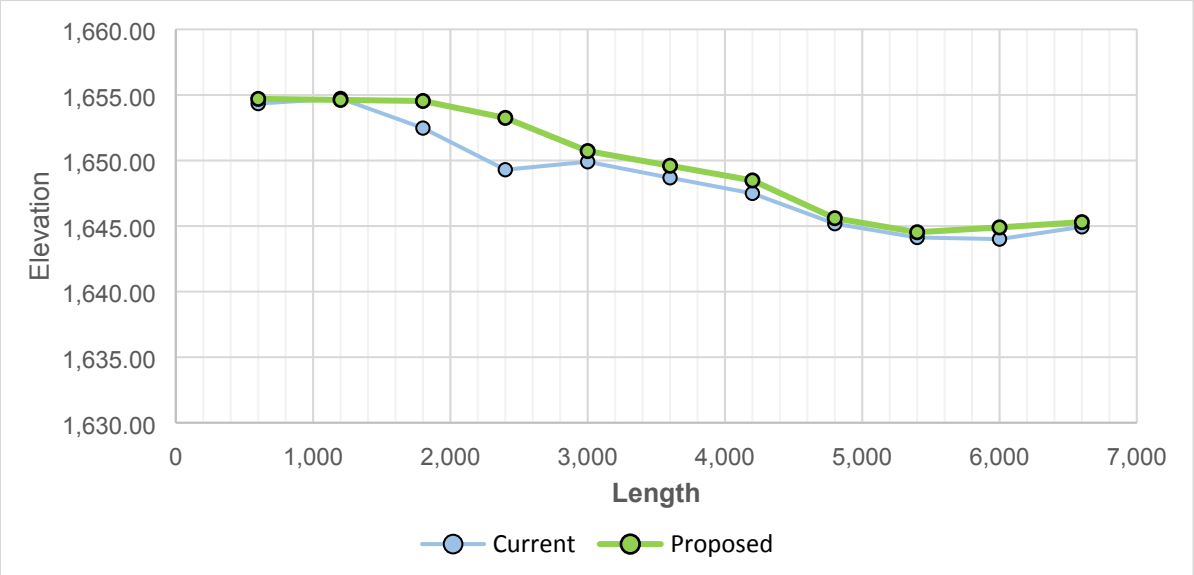
Excerpts from the 2016 EDR summarize the findings associated with the runway grading. The current Runway 13/31 profile does not meet FAA design standards as the runway

has grade changes in the first and last quarter of the runway, as shown in **Exhibit 3-6**. The proposed grading in the EDR has also been designed to meet current FAA runway grading standards; however, it should be noted that these grades are approximations and subject to change during final design. Additionally, the Runway Safety Area (RSA) of Runway 13/31 1,000 feet off the longitudinal grade changes over 2.0 percent in 100 feet. At various points along the runway, the graded shoulder does not meet grading requirements of 1.5 to 5 percent per FAA design standards. The Runway 13 end profile and Runway 31 end profile do not meet the FAA design standards, which does not allow grade changes in the first and last quarter, or first and last 2,500 feet of the runway, whichever is less. The Object Free Area (OFA) by Taxiway B does not meet FAA design standards because the existing ground is higher than the existing runway centerline elevation. The connecting Taxiway C5 profile elevation is higher than the runway centerline profile, which does not meet FAA design standards. The Airport has recently received a FAA Airport Improvement Plan (AIP) Grant which will fund the reconstruction of Runway 13/31. This AIP project is anticipated to begin in mid-2017 and will correct existing runway grade deficiencies.

3.4.4 Airfield Pavement Strength & Condition

As part of the September 2015 Pavement Condition Index (PCI), the BIS airfield was examined by Applied Pavement Technology, Inc. (APTech) under a FAA AIP planning grant to the ND Aeronautics commission to determine the condition of pavement surfaces and develop recommendations for future rehabilitation and repair. The PCI is a rating system that gives a numerical value to the existing condition of pavement based on distresses observed on the surface. To conduct this evaluation, past pavement management records were reviewed from the State of North Dakota airport pavement management system, construction history information, and traffic data. Visual pavement condition inspections were used to determine the PCI.

Exhibit 3-6: Runway 13/31 Grade



Source: Mead & Hunt, 2016
Note: Elevations are approximate and for planning purposes only.

As discussed in Chapter 1, the PCI scale ranges from a value of 0 for pavements in a completely failed condition to a value of 100 for pavement in perfect structural condition. As shown in **Table 3-15**, each PCI value corresponds to a required level of treatment in order to restore or maintain pavement to an operable condition.

The overall PCI value of BIS airfield pavements is 69 with conditions ranging from 2 to 100. The highest PCI values were found around newly constructed pavement, such as some of the apron terminal area and the recently reconstructed sections of Taxiway B. The lowest PCI values are found on various areas of Runway 13/31 (PCI 32) and near the passenger terminal (PCI 29). A summary of the PCI values for Airport surfaces can be seen in **Table 3-16** and **Exhibit 3-7** and a comprehensive list of pavement condition by branch (as labeled by Exhibit 3-7) can be seen in **Table 3-17**.

Table 3-15: Pavement Conditions	
PCI	**Condition**
100 – 71	Preventive Maintenance
70 – 41	Major Rehabilitation
40 – 0	Reconstruction

Source: 2015 Pavement Condition Index Report

Table 3-16: PCI Change over Time			
Pavement Surface Branch	**2015 PCI (Existing)**	**2020 PCI**	**2025 PCI**
Runways			
Runway 3/21	84-54	72-46	59-35
Runway 13/31	94-32	83-19	74-07
Taxiways			
Taxiway B	94	85-83	73-71
Taxiway C	79-37	66-24	58-14
Taxiway D	87-30	75-17	63-05
Taxiway E	97-2	93-0	89-0
Aprons			
Air Carrier Apron	98-29	91-10	84-0
GA Apron	100-31	94-13	87-0

Source: ND Aeronautics Commission Pavement Management System Update

Notes: Table assumes no maintenance during the periods shown.

More information on PCIs is provided in Chapter 1 Section 1.6.1

As Runway 13/31 is the primary runway at BIS and is intended to support the most demanding aircraft utilizing the Airport, any deterioration for this runway will affect usefulness of the Airport as a whole. In its present condition, the North Dakota Aeronautics Commission Pavement Management System's PCN results states that "Runway 13/31 is not structurally adequate to handle regular operations of a fully-loaded B787-8, B737-800, or MD83 aircraft." Of the airframes listed, the B737-800 and MD83 are currently operating at the Airport. As stated previously, the Airport is currently

completing the engineering design for the full reconstruction of Runway 13/31 and will be begin construction in mid-2017. The preliminary costs for maintenance and repairs based on an unlimited budget are shown in **Table 3-18**.

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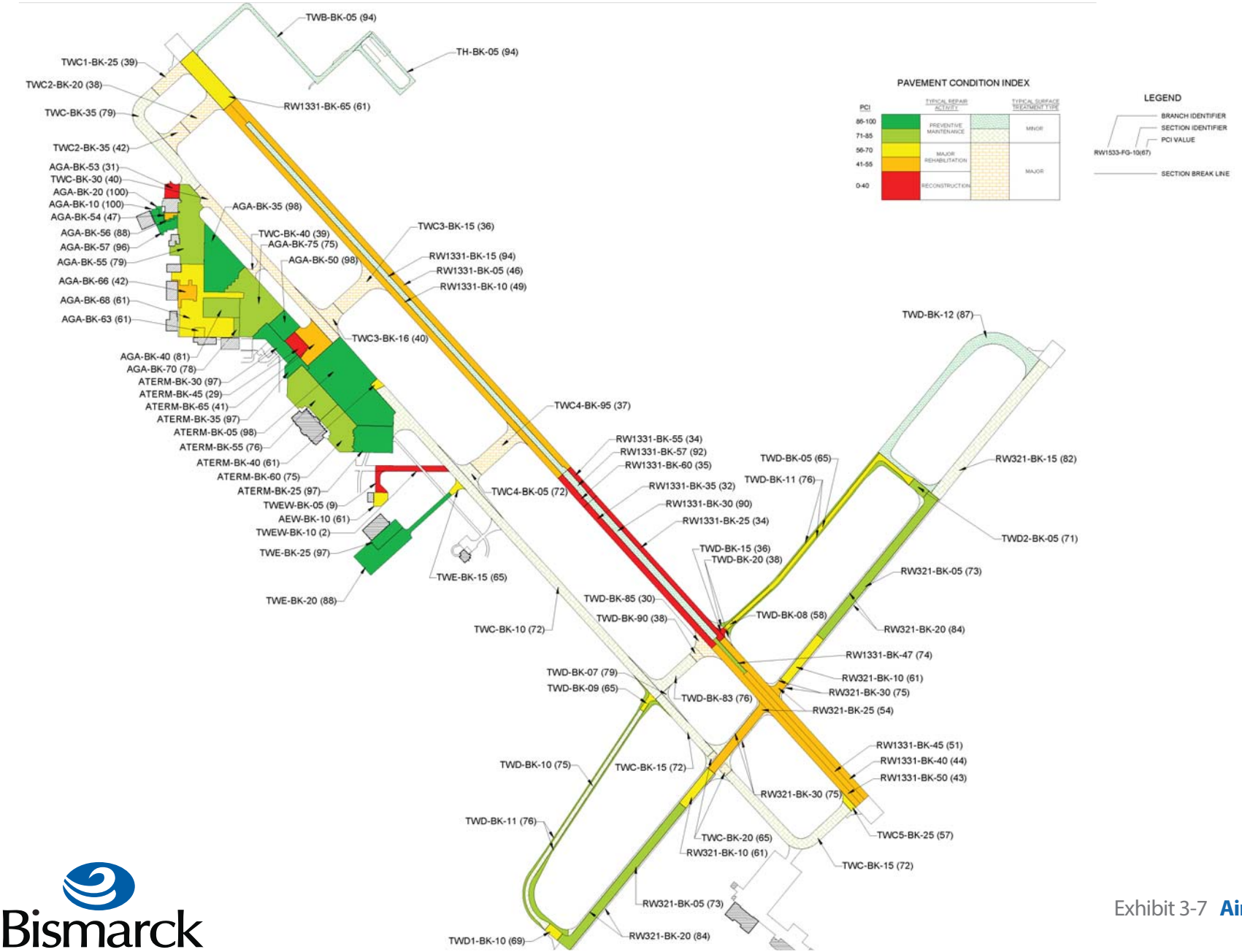

Exhibit 3-7 **Airport PCI Map**

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Table 3-17: Pavement Condition by Section				
Branch	**Section**	**Section Area (square feet)**	**Projected PCI Before Work**	**Projected PCI After Work**
AEW-BK	10	13,036	61	100
AGA-BK	35	128,898	98	99
AGA-BK	40	54,440	81	81
AGA-BK	53	16,760	30	100
AGA-BK	54	5,264	47	100
AGA-BK	*55*	146,784	79	82
AGA-BK	57	14,705	96	99
AGA-BK	63	7,177	61	100
AGA-BK	66	25,970	42	100
AGA-BK	68	172,613	61	100
AGA-BK	75	150,248	75	80
ATERM-BK	40	6,270	60	100
ATERM-BK	45	23,066	28	100
ATERM-BK	*55*	110,916	76	80
ATERM-BK	60	78,557	75	80
ATERM-BK	*65*	61,804	40	100
RW1331-BK	5	233,539	45	100
RW1331-BK	10	235,459	49	100
RW1331-BK	15	184,633	94	99
RW1331-BK	25	67,549	33	100
RW1331-BK	30	93,729	90	96
RW1331-BK	35	88,374	31	100
RW1331-BK	40	97,045	43	100
RW1331-BK	45	74,381	51	100
RW1331-BK	47	12,681	74	100
RW1331-BK	50	98,495	42	100
RW1331-BK	55	13,300	33	100

Table 3-17: Pavement Condition by Section (continued)				
Branch	**Section**	**Section Area (square feet)**	**Projected PCI Before Work**	**Projected PCI After Work**
RWI331-BK	57	19,394	92	98
RW1331-BK	60	17,688	34	100
RW1331-BK	65	85,200	60	100
RW321-BK	5	248,650	73	100
RW321-BK	10	67,010	61	100
RW321-BK	15	150,300	82	90
RW321-BK	20	104,700	84	94
RW321-BK	25	66,430	54	100
RW321-BK	30	44,486	75	93
TH-BK	5	38,825	94	100
TWB-BK	5	75,827	94	100
TWC1-BK	25	35,310	39	91
TWC2-BK	20	47,965	38	94
TWC2-BK	35	30,287	42	97
TWC3-BK	15	65,008	36	91
TWC3-BK	16	30,686	40	96
TWC4-BK	5	27,213	72	92
TWC4-BK	95	65,520	37	80
TWC5-BK	25	7,390	57	100
TWC-BK	10	295,514	72	88
TWC-BK	15	174,205	72	90
TWC-BK	20	9,800	65	81
TWC-BK	30	145,819	40	92
TWC-BK	35	108,925	79	99
TWC-BK	40	8,150	39	95
TWD1-BK	10	10,460	69	78
TWD2-BK	5	12,390	71	78
TWD-BK	5	82,960	65	100

Table 3-17: Pavement Condition by Section (continued)				
Branch	**Section**	**Section Area (square feet)**	**Projected PCI Before Work**	**Projected PCI After Work**
TWD-BK	7	5,703	79	93
TWD-BK	8	3,330	58	100
TWD-BK	9	7,090	65	100
TWD-BK	10	80,760	75	80
TWD-BK	11	157,430	75	100
TWD-BK	12	169,760	87	90
TWD-BK	15	2,990	35	100
TWD-BK	20	7,260	38	87
TWD-BK	83	43,250	76	91
TWD-BK	85	21,000	30	82
TWD-BK	90	7,780	38	85
TWE-BK	15	7,380	65	97
TWE-BK	20	96,280	88	94
TWEW-BK	5	10,449	9	100
TWEW-BK	10	29,125	2	100

Source: 2015 PCI Study

Table 3-18: BIS Five Year Repair Cost				
Area	**Preventative maintenance**	**Surface Treatment**	**Major Maintenance and Rehabilitation**	**Total**
GA Apron Total	$18,219	$0	$2,691,574	$2,709,793
Air Carrier Apron Total	$171,416	$0	$1,044,271	$1,215,687
Runway 13/31 Total*	$0	$232,250	$9,900,173	$10,132,423*
Runway 3/21 Total	$3,397	$291,431	$2,134,644	$2,429,472
Taxiway B Total	$0	$89,429	$0	$89,429
Taxiway C Total	$20,323	$1,149,055	$59,490	$1,228,868
Taxiway D Total	$7,136	$289,812	$1,313,690	$1,610,638
Taxiway E Total	$83,636	$11,513	$464,203	$559,352
Grand Total	***$304,127***	***$2,063,490***	***$17,608,045***	***$19,975,662***

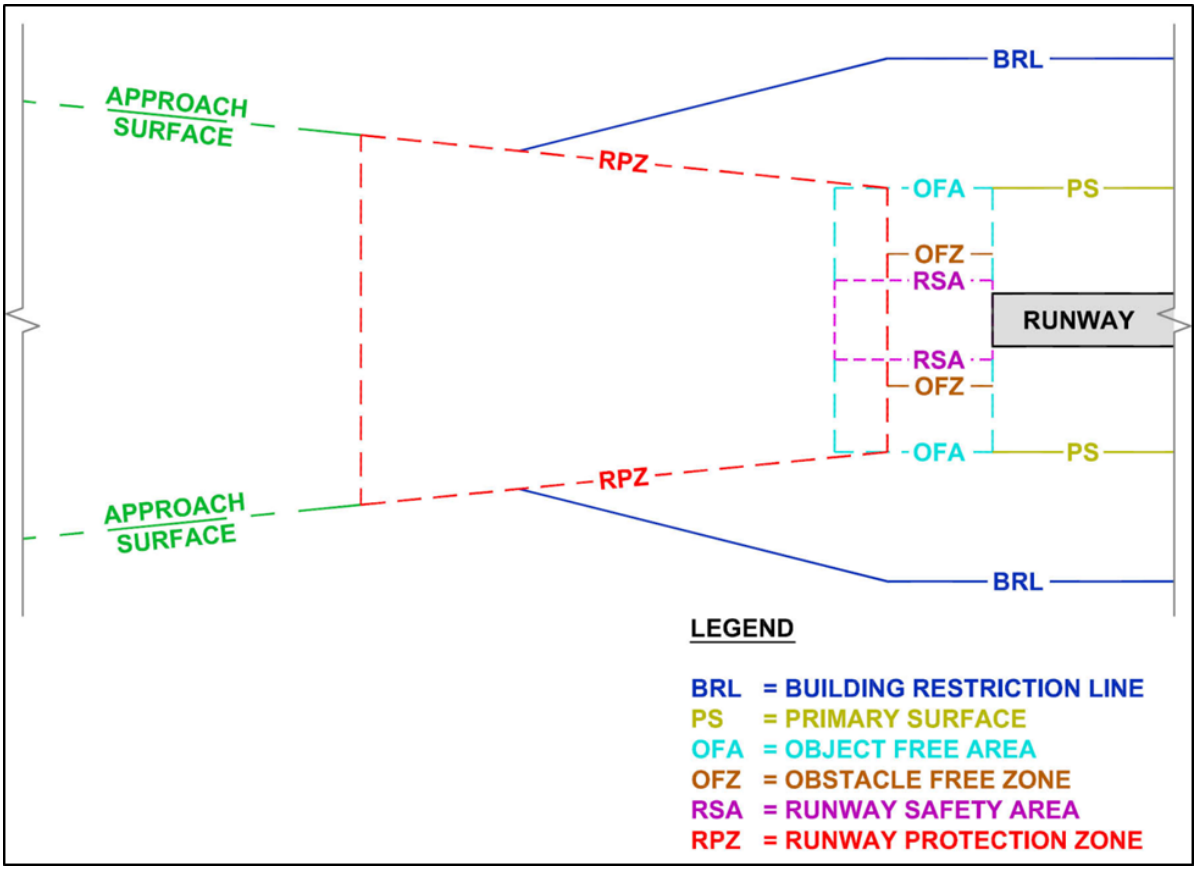
Source: 2015 PCI Study Executive Summary

*Runway 13/31 has since been slated for a full reconstruction at a cost of $69,000,000

3.4.5 Runway Design Surfaces

In addition to the length, width, and strength of the pavement surface, there are also a number of other design components associated with runways that protect aircraft from obstructions and provide a margin of safety in the event of an unintentional deviation from the runway. As illustrated in **Exhibit 3-8** below and in Exhibit 3-2, in the beginning of this chapter, these surfaces include safety areas, object free areas, and protection zones. The following section reviews each of these design surfaces as they are associated with BIS runways, and evaluates if dimensional changes will be needed to accommodate aircraft that are project to operate there during the planning period.

Exhibit 3-8: Runway Design Surfaces



Source: Mead & Hunt, Inc. (2016)

Runway Safety Area – The Runway Safety Area (RSA) is a two-dimensional surface at the elevation of the runway that is centered on the extended centerline which provides an area to support an aircraft in the event of an unintended excursion from the runway surface. According to FAA AC 150/5300-13A, *Airport Design*, runway safety areas must be:

- Cleared, graded, free of hazardous surface variations, and properly drained.
- Capable of supporting an aircraft without causing structural damage as well as airfield maintenance and emergency response vehicles.

- Free of objects except those which are necessary such as navigational signs and lighting upon which must be mounted on low-impact resistant supports.

The dimensions of the RSA for each runway are shown below in **Table 3-19**.

Table 3-19: RSA Dimensions				
Runway	**RDC**	**Length Beyond Departure End**	**Width**	**Length Prior to Threshold**
Runway 13/31	D-III	1000	500	600
Runway 3/21	C-II	1000	500	600

Source: FAA AC 150/5300-13A, *Airport Design*

As noted, the RSA must be kept free of objects except those necessary by function. The Runway 31 RSA extends 1,000 feet beyond the approach end of the runway, and the localizer antenna for Runway 31 is located 1,000 feet from the approach end of the runway, outside of the RSA. It should be noted that the FAA has recently placed an emphasis on maintaining safety areas that meet design standards and are free of all objects, except those necessary by function which must be mounted on low-impact resistant supports. Most of the objects within the RSA, such as potions of the approach lighting system, are fixed by function with the RSA. However, it is possible to reduce the presence of the radar and MALSR access roads within the RSA. The upcoming runway rehabilitation project will consider rerouting these access roads to minimize conflicts with the RSA.

Grading of the RSA is also important to allow for emergency and maintenance vehicles to access aircraft deviating from the runway. The grading along the extended centerline is not within current FAA standards. According to AC 150/5300-13A, *Airport Design*, the first 200 feet of the RSA beyond the runway ends, the longitudinal grade should be between 0 and 3.0 percent. The remainder of the grade may not allow penetration of the

RSA with any applicable approach surface or clearway plane. Although neither end of Runway 13/31 meets this standard, the upcoming Runway 13/31 rehabilitation project will bring the grading back into current FAA RSA grading standards.

Runway Object Free Area – The Runway Object Free Area (ROFA) is also a two-dimensional ground area at the elevation of the runway and centered on its extended centerline; however, the function of the ROFA varies from the RSA in that it is intended to protect aircraft operating on the runway and within the RSA from colliding with objects. It should be noted that the FAA prohibits aircraft from parking within the OFA, except for ground maneuvering purposes, and all above-ground objects protruding from the edge of the RSA elevation, except those fixed by function for navigational purposes. Dimensions of an ROFA are based on the critical design aircraft intended to use a runway and its approach visibility minimums. The ROFA for Runway 13/31 and Runway 3/21 is 800 feet wide and extends 1,000 feet beyond each runway end meeting design standards for RDC category D-III and C-II aircraft, respectively.

The glide slope antenna for Runway 31 lies within the ROFA for Runway 3/21. In addition, the Runway 13 glideslope is less than 400 feet from the centerline of Runway 13/31 and lies within the ROFA. Both glideslopes are owned and maintained by FAA. While above-ground objects that are fixed by function for navigational purposes can protrude from the edge of the RSA elevation within the OFA, the FAA recommends that glide slope antennas be located a minimum of 400 feet from the centerline of a runway. The Runway 13/31 EDR report considered the relocation of the glide slope antenna for Runway 31; however, it was recommended to keep this glide slope in its current location based on the decision to maintain Runway 13/31 at its current length. Neither BIS nor the FAA plan to relocate the Runway 31 glideslope antenna as part of the Runway 13/31 reconstruction project. The potential relocation of the Runway 13 glideslope antenna will be examined during the airport alternatives chapter. Finally, a small segment of the airport perimeter

roadway extends into the ROFA located north of Runway 13. Current FAA standards prohibit roads within critical safety areas such as the ROFA; however, because the road is used solely by the Airport for perimeter access and is located in the far northern corner of the ROFA, FAA has allowed the road to remain in its current location. Options for achieving FAA ROFA compliance will be addressed during the airport alternatives chapter. Finally, the ROFA also overlaps the airport perimeter road north of Runway 13.

Obstacle Free Zone – The Obstacle Free Zone (OFZ) is a three-dimensional volume of airspace located along the runway and beyond its end. Clearing standards prohibit taxiing aircraft, parked aircraft, vehicles, and other objects, except those fixed by function, from being located within the OFZ when aircraft are departing from or arriving to a runway surface. The OFZ is comprised of three design elements, each of which are described in the following summaries:

- **Runway Obstacle Free Zone –** The Runway Obstacle Free Zone (ROFZ) extends 200 feet beyond the end of a runway at a width determined by the type of aircraft conducting operations on the runway surface. Since all the runways are designated for use by aircraft over 12,500 pounds, the ROFZ width is 400 feet for all runways. As there are no known noncompliant objects within the ROFZ's, no improvements are anticipated to be needed to the ROFZs associated with these runways.
- **Inner-approach OFZ –** The inner-approach OFZ is a volume of airspace centered on the runway centerline and only applies to runways with an approach lighting system (ALS). The inner approach OFZ begins 200 feet beyond the runway threshold and extends 200 feet beyond the last light unit in the ALS. The width is the same as the ROFZ and rises at a slope of 50:1 outward and upward from the beginning of the surface located 200 feet beyond the end of the runway. Since only Runways 13 and 31 are equipped with an ALS, an inner approach OFZ is located 200 feet beyond the end of the runway at a width of 400 feet and extends outward and upward at a slope of 50:1 to a horizontal distance of 2,980 feet on the 13 end and 2,660 feet off the 31 end, which extends 200 feet beyond the last light units of

the ALS. The inner-approach OFZ at the approach ends of Runways 13 and 31 meet FAA design standards; as such, improvements are not anticipated during the planning period.

Runway Protection Zone – The Runway Protection Zone (RPZ) is designed to enhance the protection of people and property on the ground. RPZs are to be controlled by an airport and be clear of any incompatible land uses such as occupied buildings, concentrations of people, wildlife attractants, and objects of height. The RPZ is trapezoidal in shape and centered on the extended centerline of the runway located 200 feet beyond the end of a paved runway surface with an inner and outer width that is based on the AAC of the critical design aircraft and type of approach to the runway. **Table 3-20** presents the dimensions of the approach RPZ located at either end of each runway.

Table 3-20: Runway Protection Zone Dimensions

Dimensions	Runway			
	31	13	03	21
Runway Design Code (RDC)	D-III	D-III	C-II	C-II
Visibility Minimums (miles)	1/2	3/4	3/4	1
Length	2,500 feet	1,700 feet	1,700 feet	1,700 feet
Inner Width	1,000 feet	1,000 feet	1,000 feet	1,000 feet
Outer Width	1,750 feet	1,510 feet	1,510 feet	1,510 feet

Source: FAA Advisory Circular 150/5300-13A, *Airport Design*

It should be noted that the dimensions of the RPZs found at each end of all runways meet FAA design standards as identified in FAA AC 150/5300-13A, *Airport Design*, for their respective RDC categories if the approach visibility minimums to either end of the runways remain unchanged. Changes to the dimensions and/or locations to the RPZs are only anticipated if a runway is extended and/or an instrument approach with lower visibility is developed for the runway. The FAA recommends that land within an RPZ be controlled by an airport to prevent and eliminate incompatible objects and activities for

the protection of people and property on the ground. Should any runway be extended, or an approach with increased visibility minimums be developed, the acquisition of land or an easement may be needed should any portion of a relocated or increased RPZ fall outside existing Airport property to control incompatible land uses. Existing easements for the RPZs include the northern portion of the Runway 13 RPZ and the eastern section of the Runway 31 RPZ. Both easements are outside of the perimeter fence. RPZs for Runway 3/21 are owned entirely by the Airport.

There are some public roadways within the RPZs, such as Airport Road near the approach end of Runway 13 and Yegan Road near the approach end of Runway 31. The elevation of Yegan Road exceeds the elevation of Runway 31 end by approximately 10 feet. Based on current FAA RPZ guidance, public roadways within the RPZ are highly discouraged and may have to be relocated if Runway 13/31 is ever extended. In contrast, the elevation of Airport Road is approximately 10 feet less than the elevation of Runway and does not have an adverse effect on the Airport. Additionally, none of the RPZs include any land uses that are residential or places of assembly. Therefore, the RPZs comply with the interim FAA design standards guidance. Based upon the interim guidance, regional and ADO staff must consult with FAA Headquarters if any of the conditions in **Table 3-21** are met.

Table 3-21: New or Modified Land Uses in the RPZ Requiring Coordination
1. An airfield project (e.g., runway extensions, runway shift)
2. A Change in the critical design aircraft that increases the RPZ dimensions
3. A new of revised instrument approach procedure that increases the RPZ dimensions
4. A local development proposal in the RPZ (either new or reconfigured)

Source: FAA *Interim RPZ Guidance*, 2012.

In addition to the physical dimensions of the runways, there are also a few design components associated with the runway to ensure safety by protecting aircraft from obstruction and provide a buffer area in the event on an unintentional deviation from the runway. This section will provide a review of the purpose and dimensions of each of these design surfaces as they are associated with BIS and evaluate any necessary changes during the planning period.

Threshold Sitting Requirements

The threshold of the runway is generally where the takeoff roll begins and the landing roll ends. The approach and departure surfaces associated with the threshold are intended to protect the use of the runway for arriving and departing aircraft. The specific dimensions of these surfaces are determined based off the type of aircraft that the runway is intended to serve, and the approach types associated with the runway. The dimensions of each surface are shown below based on runway type in **Exhibit 3-9** and **Exhibit 3-10**.

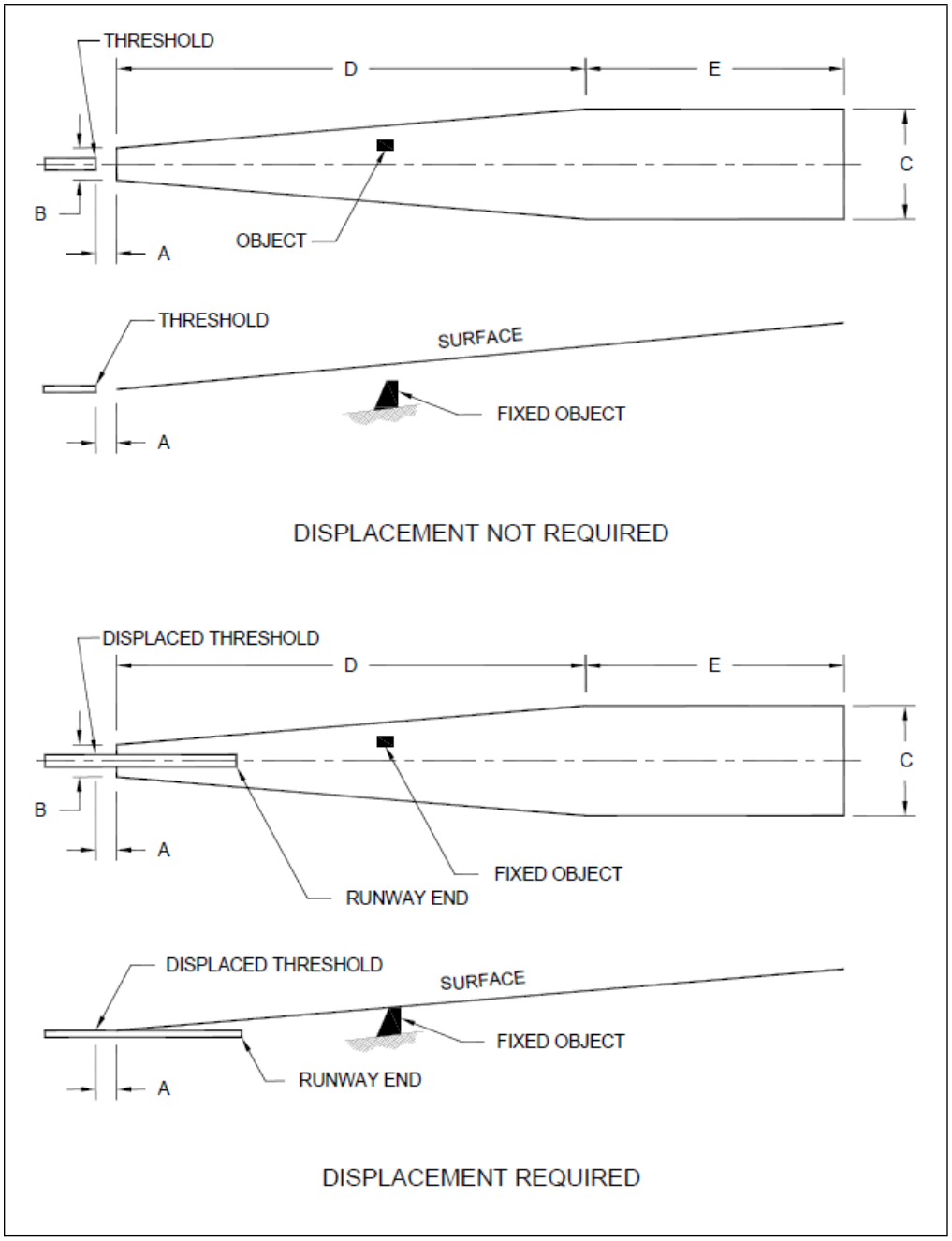
As Runway 13/31 offers vertical guidance due to its ILS approaches, it is categorized as a Type 8 runway. Runway 3/21, due to its lack of instrument approaches with visibility minimums less than 3/4 mile is classified as a Type 6 Runway. The dimensions of the approach surfaces for each of these runways are depicted in Exhibit 3-10.

Exhibit 3-9: Approach/Departure Standards Table

Runway Type		DIMENSIONAL STANDARDS* Feet (Meters)					Slope/ OCS
		A	B	C	D	E	
1	Approach end of runways expected to serve small airplanes with approach speeds less than 50 knots. (Visual runways only, day/night)	0 (0)	120 (37)	300 (91)	500 (152)	2,500 (762)	15:1
2	Approach end of runways expected to serve small airplanes with approach speeds of 50 knots or more. (Visual runways only, day/night)	0 (0)	250 (76)	700 (213)	2,250 (686)	2,750 (838)	20:1
3	Approach end of runways expected to serve large airplanes (Visual day/night); or instrument minimums ≥ 1 statute mile (1.6 km) (day only).	0 (0)	400 (122)	1000 (305)	1,500 (457)	8,500 (2591)	20:1
4	Approach end of runways expected to support instrument night operations, serving approach Category A and B aircraft only. [1]	200 (61)	400 (122)	3,800 (1158)	10,000 [2] (3048)	0 (0)	20:1
5	Approach end of runways expected to support instrument night operations serving greater than approach Category B aircraft. [1]	200 (61)	800 (244)	3,800 (1158)	10,000 [2] (3048)	0 (0)	20:1
6	Approach end of runways expected to accommodate instrument approaches having visibility minimums ≥ 3/4 but <1 statute mile (≥ 1.2 km but < 1.6 km), day or night.	200 (61)	800 (244)	3,800 (1158)	10,000 [2] (3048)	0 (0)	20:1
7	Approach end of runways expected to accommodate instrument approaches having visibility minimums < 3/4 statute mile (1.2 km).	200 (61)	800 (244)	3,800 (1158)	10,000 [2] (3048)	0 (0)	34:1
8[3,5,6,7]	Approach end of runways expected to accommodate approaches with vertical guidance (Glide Path Qualification Surface [GQS]).	0 (0)	Runway width + 200 (61)	1520 (463)	10,000 [2] (3048)	0 (0)	30:1
9	Departure runway ends for all instrument operations.	0 [4] (0)	See Figure 3-4.				40:1

Source: AC 150/5300-13A, *Airport Design*

Exhibit 3-10: Threshold Siting Based on Approach Slope



Source: AC 150/5300-13A, *Airport Design*

Federal Aviation Regulation Part 77 Surfaces

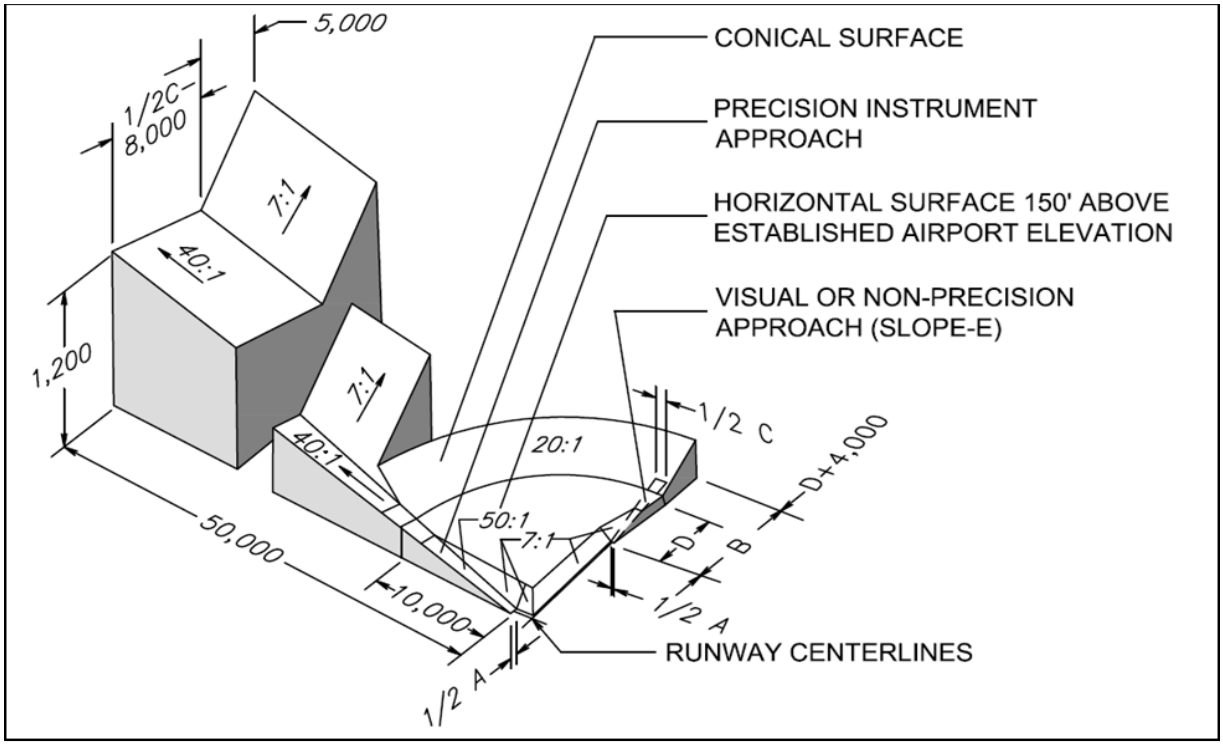
Airspaces surrounding the Airport allow the transition from the National Airspace System to the airport and other destinations. To provide a safe environment during takeoff, landing, and transition in and out of the airspace, Federal Aviation Regulation (FAR) Part 77, Safe Efficient Use and Preservation of the Navigable Airspace, enacts five "imaginary surfaces" that surround physical Airport surfaces. The dimensions of each of these surfaces are based on the category of runway as defined by FAR Part 77 and the most precise approach (existing or planned) for a runway end. A description of the five FAR Part 77 imaginary surfaces and discussion of their dimensions as they relate to the BIS runways are presented in the following sections and are illustrated in **Exhibit 3-11**.

Primary Surface – The primary surface is a two-dimensional surface centered longitudinally on a runway and extends 200 feet beyond the end of a prepared hard surface (or at the end of a runway if there is no prepared hard surface). The elevation of the primary surface is the same elevation as the nearest point on the runway centerline and has a width based upon the designation of the runway and type of the approach. For paved runways, such as the runways at BIS, the primary surface extends 200 feet beyond the end of that runway, while the width is determined by the approach to the runway. Runway 13/31 is equipped with a precision Instrument Landing System (ILS) approach to each end; therefore, the width of the primary surface is 1,000 feet. Runway 3/21 is equipped with a GPS RNAV approach and has visibility limits of 3/4 miles; therefore, the primary surface also has a width of 1,000 feet.

Approach Surface – The approach surface is centered longitudinally on the extended runway centerline and extends outward and upward from each end of the primary surface. The dimensions of the approach surface at each end of a runway is based upon the type of approach available or planned for that runway end. The inner width of the approach

surface is the same width as the primary surface and expands uniformly. Dimensions for each aspect of the approach surface are shown for each runway in **Table 3-22**.

Exhibit 3-11: Federal Aviation Regulation Part 77 Surfaces



Source: FAA AC 150/5070-6B *Airport Master Plans*, 2007

Transitional Surface – The transitional surface extends outward and upward at right angles to the extended runway centerline at a slope of 7:1 from the sides of the primary approach surface. Those portions of the transitional surface adjacent to precision approach surfaces, which project through and beyond the limits of the conical surface, extend to a distance of 5,000 feet measured horizontally from the edge of the approach surface and at right angles to the runway centerline.

Table 3-22: Runway Approach Surfaces Dimensions		
Dimensions	**Runway 13/31**	**Runway 3/21**
Inner Width	1,000 feet	1,000 feet
Outer Width	16,000 feet	3,500 feet
Horizontal Distance	10,000 feet / 40,000 feet*	10,000
Slope	50:1 / 40:1*	34:1

Note: *Runway 13/31 has a two stage horizontal distances. The slope and distance for each state
Source: FAA AC 150/5300-13A *Airport Design*

Horizontal Surface – The horizontal surface is a plane 150 feet above the elevation of an airport whose perimeter is constructed by swinging arcs of specified radii from the center of each end of the primary surface for each runway at an airport and connecting the adjacent arcs by lines of tangent. The radius of each arch is 10,000 feet for any runway that is intended to be used by aircraft above 12,500 pounds or has an instrument approach. Therefore, the radii of the arc found at the Runway 13/31 and Runway 3/21 end is 10,000 feet.

Conical Surface – The conical surface extends outward and upward from the periphery of the horizontal surface at a slope of 20:1 for a horizontal distance of 4,000 feet. Objects that penetrate the FAR Part 77 surfaces are hazards to air navigation unless determined otherwise by an aeronautical study conducted by the FAA. It should be noted that aeronautical studies only determine if an object is a hazard to air navigation and do not give the FAA specific authorization to limit the height of objects that may be identified as hazards to air navigation. As such, it is the responsibility of an airport to work with state or local governmental jurisdictions to control objects that may penetrate FAR Part 77 surfaces. Objects that are identified as hazards to air navigation should be removed (or pruned in the case of vegetation) or illuminated with an obstruction light if the objects cannot be removed or are fixed by function.

3.5 TAXIWAY SYSTEM

The design standards of a taxiway are based on the combination of the TDG and ADG classification of the critical aircraft intended to operate on the surface. Based on the classification of the aircraft utilizing the taxiways, the dimensions of the taxiway and its associated surfaces are determined. Like runways, taxiways are designed to protect aircraft and the surrounding people and property in the event of an unintended excursion from the taxiway surface.

There are two primary full parallel taxiways at BIS: Taxiway C, serving Runway 13/31; and Taxiway D, serving Runway 3/21. As Runway 13/31 is the primary runway for BIS, it generally is utilized by the commercial air carriers. This means that the most demanding aircraft use the associated taxiway system as it leads to the passenger terminal area. Runway 3/21 is the crosswind runway and offers another option for small aircraft to land during stronger crosswind conditions and connects to the army aviation support facility. However, Runway 3/21 alignment does offer noise abatement advantages compared to the primary runway as the extended centerline of Runway 3/21 is less densely populated. Therefore, the aircraft that use Runway 3/21's associated taxiway, Taxiway D, are generally smaller aircraft, such as corporate and other general aviation aircraft and some air carrier traffic, such as the Airbus 319. The TDG for each taxiway system and dimensions of the design surfaces associated with the TDG are shown in **Table 3-23**. Per an agreement between the Airport and the FAA, Taxiways C, C1, C3 and a small segment of Taxiway D (between RW 13/31 and TW C) will be designed at TDG 5 to accommodate larger aircraft taxiing to and from Runway 3/21. The remaining segments of TW D are designated as TDG 3. The remainder of this section will analyze the dimensions of the taxiways in comparison to the standards and general layout of the taxiway system.

Table 3-23: Taxiway Dimensions and Standards					
ADG	**I**	**II**	**III**	**IV**	**V**
Taxiway Safety Area	49 feet	79 feet	118 feet	171 feet	214 feet
Taxiway Object Free Area	89 feet	131 feet	186 feet	259 feet	320 feet
Taxilane Object Free Area	79 feet	115 feet	162 feet	225 feet	276 feet
TDG	**1B**	**2**	**3**	**4**	**5**
Taxiway Width	25 feet	35 feet	50 feet	50 feet	75 feet
Taxiway Edge Safety Margin	5 feet	7.5 feet	10 feet	10 feet	15 feet
Taxiway Shoulder Width	10 feet	15 feet	20 feet	***20 feet***	***30 feet***

Note: Bold italicized text indicates that standards are not met.

Terminal facilities are located outside the TOFA and TSAs; however, Taxiways C, its connectors, and Taxiway D (between Taxiway C and Runway 13/31) are lacking paved shoulders. Similar to paved shoulder for runways, paved taxiway shoulders help to protect against erosion from jet blast and support maintenance and emergency operations. Although the width of these taxiways tends to exceed current FAA standards, any future reconstruction of the taxiways should consider incorporating paved shoulders.

In addition to taxiway layout, other aspects of the taxiway dimensions including taxiway width, turn radii, and other dimensions of the paved area are centered on the design concept of the Taxiway Edge Safety Margin (TESM). The TESM is a design feature intended to ensure that there is extra pavement beyond the wheel of a taxiing aircraft. Taxiway width and dimensions are designed with the intention of maintaining a certain TESM per design group to provide an additional margin of safety. TESM is used in conjunction with other mandatory dimensions to help provide a buffer of protection around taxing aircraft. As most of the taxiways at BIS are of sufficient or greater width for their TDG, the required TESM is provided except for around turns due to the fillets.

One important consideration when considering taxiway standards is the width of fillets around turns. Fillets are the extra portion of pavement that temporarily increases the width

of the taxiway during turns. This extension compensates for the fact that while the nose gear of an aircraft may be able to closely trace the centerline of a taxiway, the main gear follows an asymmetrical turn and does not remain centered. Fillets allow for the wheels of an aircraft to maintain the designed TESM. However, the taxiways at BIS are either lacking fillets or have non-standard fillets. By adding fillets to the turns, the taxiway system would be able to meet higher TDG standards. The FAA approved TDG classifications for each area of the taxiway systems are shown in **Exhibit 3-12**. The non-standard fillets are a preexisting condition from before the AC 150/5300-13A was published in 2012. Therefore, as taxiways are reconstructed, it is recommended to incorporate these fillets into future design to meet standards and allow for the asymmetrical turning nature of air carrier aircraft. More information on taxiway dimensions is depicted on the ALP and in **Table 3-23**.

Finally, the layout of the taxiway system should be considered. FAA AC 150/5300-13A, *Airport Design*, recommends that taxiways that connect from aprons not have direct access to a runway. Pilots generally anticipate that aprons will connect to parallel taxiways and so a taxiway connecting directly from the apron to the runway, without a necessary turn first, may disorient pilots and create a situation in which a runway incursion is could occur. Taxiways C3, C4, and C5 all allow for direct access onto nearby aprons. Reconfiguration of the taxiways or apron will be evaluated during the alternatives evaluation process to comply with current FAA guidance.

In conclusion, the current taxiway system at BIS is expected to be able to serve the anticipated aircraft throughout the planning period. However, correcting the taxiways that lead directly onto the runway from the apron would increase safety and correct existing discrepancies. Additionally, adding fillets to the taxiways at BIS would serve to increase the TDG of the taxiways while adding only a minimal amount of pavement.

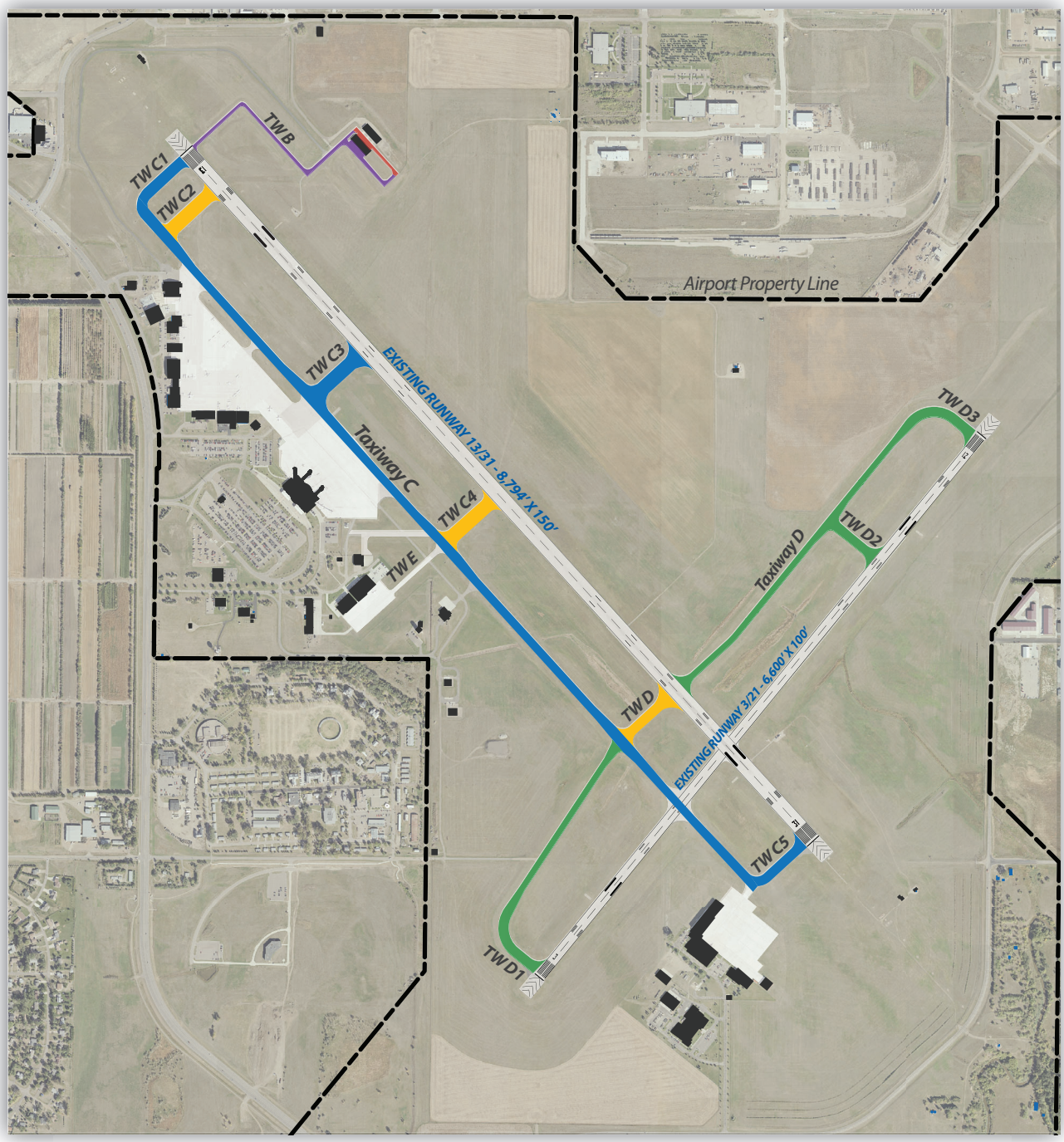


Exhibit 3-12 **Taxiway System Designations**

3.6 GA APRONS

The function of an apron is to provide an area for aircraft to maneuver, load and unload passengers, and to support fueling, maintenance, and parking. The size of the apron comprises several factors including purpose of the apron, number of parking positions, and the type of aircraft intended to use the area. Peak operations should also be considered during apron design to determine the size of aprons during these times of high demand. Based on these factors, an analysis was conducted to determine the amount of apron space that will be needed to accommodate demand throughout the planning period. **Table 3-24** shows the required apron space for the planning period.

Table 3-24: Apron Demand

Criteria	2015	2020	2025	2030	2035
Annual GA Itinerant Operations	25,131	26,770	27,795	28,622	29,643
Percentage of Total Ops in Peak Month	10.20%	10.20%	10.20%	10.20%	10.20%
Peak Month Operations	2,563	2,731	2,835	2,919	3,024
Peak Month Average Day Operations	85	91	95	97	101
Existing apron area (sq ft)	750,000	750,000	750,000	750,000	750,000
Itinerant Apron Demand per Aircraft (sq ft)	5,625	5,625	5,625	5,625	5,625
Total Itinerant Apron Demand (sq ft)	480,630	511,976	531,579	547,396	566,922
Apron Surplus (+) / Deficiency (-)	269,370	238,024	218,421	202,604	183,078

Source: Mead & Hunt, 2016.

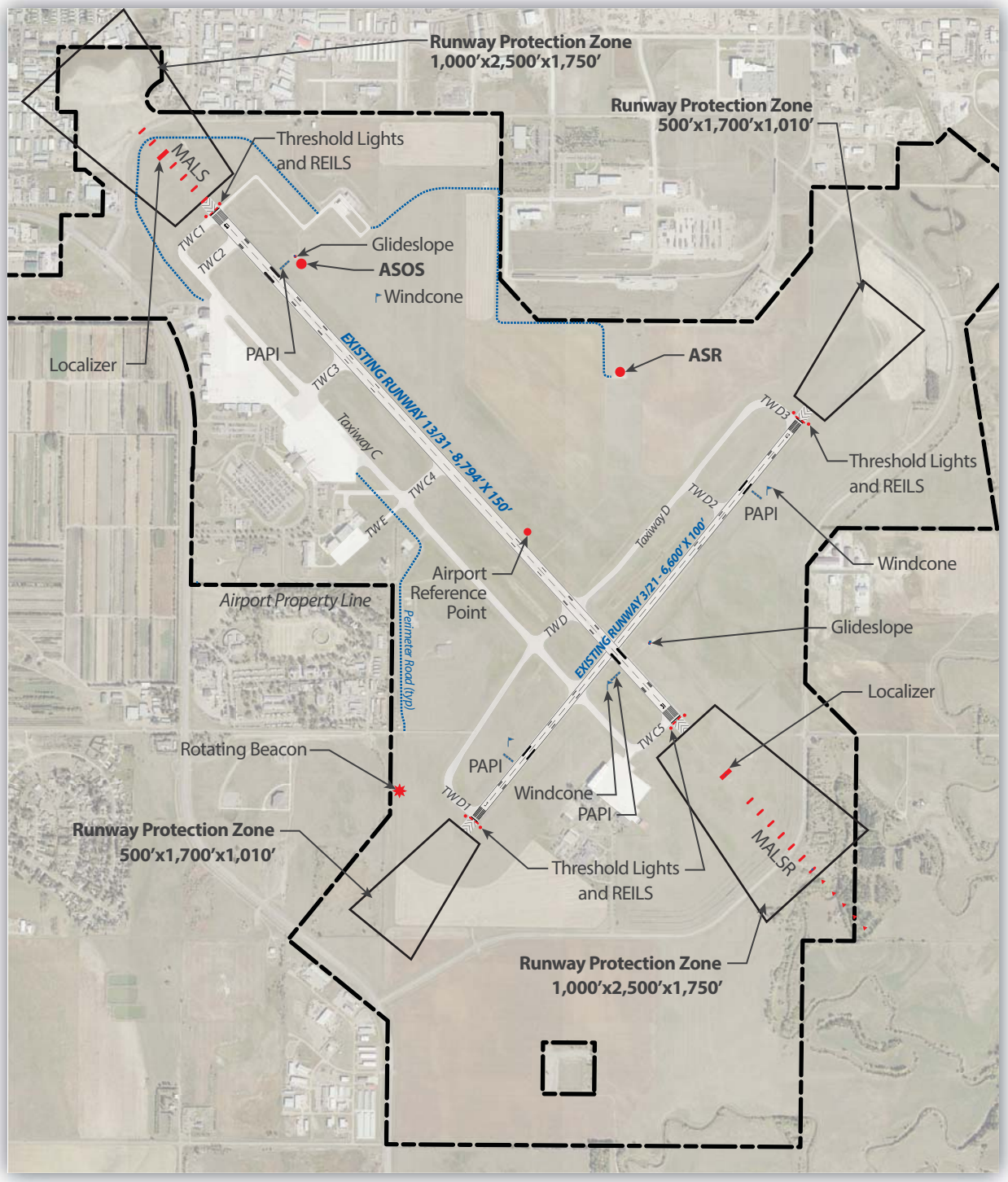
Itinerant GA aircraft operations have made a strong recovery since the 2008 recession. However, existing apron is expected to meet the needs of itinerant aircraft for the duration of the planning period with a surplus of 183,078 square feet. Like runways and taxiways, aprons have surface gradient design standards as identified in FAA AC 150/5300-13A, *Airport Design*, to ease aircraft towing and taxiing while promoting positive drainage. Gradient design standards are based upon the AAC of the most demanding type of aircraft intended to operate on the surface. For AACs A and B, the maximum allowable

grade in any direction is two percent while the maximum allowable grade for AACs C, D, and E is one percent. The existing aircraft aprons at BIS comply with current FAA gradient design standards. While these aprons meet FAA standards, previous flooding has occurred during periods of extensive rainfall which surpassed 100-year flood levels.

There are existing plans to expand the GA apron approximately 650 feet to the northwest parallel to the primary runway. This would allow the FBO to expand their facilities, remove some of the outdated hangers, and build new additional hangars to better serve corporate aircraft. The apron expansion, proposed in the 2015 Environmental Assessment, would allow for additional hangars to be constructed near Taxiway C, an accessible area and prime real estate for future development. Hangar demand is covered in more detail in section 3.9.3.

3.7 NAVIGATIONAL AIDS AND WEATHER EQUIPMENT

Visual and electronic guidance for pilots on approach to land and during takeoff are provided by Navigational Aids (NAVAIDs) that are either physically on an airfield, are other nearby ground-based electronic equipment, or guidance from orbiting satellites. The Airport's existing NAVAIDS are shown on **Exhibit 3-13**. Several factors such as the type and volume of aviation activity, local meteorological conditions, and established instrument approach procedures dictate the types of NAVAIDs that should be installed at an airport. Several FAA documents such as AC 150/5300-13A, *Airport Design*; FAA Order 7031.2C, *Airway Planning Standard Number One – Terminal Air Navigation Facilities and Air Traffic Control Services*; FAR Part 139, *Certification of Airports*, and the *Aeronautical Information Manual (AIM)* offer guidance on the type of visual and electronic NAVAID equipment needed to meet the projected demand. NAVAIDs are discussed in this section by two categorizations: Visual NAVAIDs and electronic NAVAIDs.


Runway Protection Zone
1,000'x2,500'x1,750'
Runway Protection Zone
500'x1,700'x1,010'
Threshold Lights
and REILS
MALS
TW C1
TW C2
Glideslope
ASOS
Windcone
PAPI
Localizer
EXISTING RUNWAY 13/31 - 8,794' X 150'
TW C3
Taxiway C
TW C4
TW E
ASR
TW D3
Threshold Lights
and REILS
TW D2
Taxiway D
PAPI
Windcone
Airport
Reference
Point
Airport Property Line
Perimeter Road (typ)
TW D
EXISTING RUNWAY 3/21 - 6,600' X 100'
Glideslope
Localizer
Rotating Beacon
TW C5
PAPI
TW D1
Windcone
PAPI
Runway Protection Zone
500'x1,700'x1,010'
Threshold Lights
and REILS
MALSR
Runway Protection Zone
1,000'x2,500'x1,750'
0
1,000'
2,000'
3,000'
Graphic Scale in Feet

This section will also review the weather equipment currently installed at BIS. This equipment provides important information to pilots that impact navigation procedures, such as wind direction, wind speed, visibility, cloud ceiling height, and local atmospheric conditions such as rain and snow. This review, which is presented at the end of the section, will focus on whether any upgrades or relocation of the equipment is necessary to improve the accuracy of weather condition reporting at BIS.

3.7.1 Visual Navigational Aids

Navigational devices that require optic recognition by a pilot are visual NAVAIDs and include devices such as approach lighting, windsocks, and signage. Visual NAVAIDs are most beneficial in assisting a pilot to visually locate a runway and complete the transition from flight to touchdown. It should be noted that visual NAVAIDs often compliment electronic NAVAIDs and may be required in certain circumstances to fulfill the installment of the electronic NAVAID for purposes of safety and accuracy. The following summarizes the review that was conducted of each visual NAVAID and discusses any improvements that may be necessary for the device to continue to provide accurate navigational information to pilots.

Rotating Beacon – A rotating beacon is a high intensity light that rotates 360 degrees and is operated during low visibility situations, such as at night and in inclement weather, to assist pilots in identifying the location of an airport from the air. Rotating beacons are equipped with a green and white lens separated 180 degrees from each other so that alternating green and white flashes can be viewed from the air signaling to pilots that an airport is available for public use. The airport-owned rotating beacon at BIS is located on a freestanding tower just west of the Runway 3 end. There are no obstructions or surrounding terrain that obstruct viewing of the light beam; as such, no improvements,

such as relocation of the rotating beacon or mitigation of possible obstructions, are necessary.

Wind Indicators – Wind indicators (also known as wind socks or wind cones) are orange cone-shaped fabric devices that visually indicate wind strength and direction. Wind indicators are most beneficial to pilots just prior to landing and during takeoff, when aircraft are most impacted by surface winds. Four wind indicators are located at the Airport, all of them being illuminated and located near each end runway end. No additional wind indicators are necessary to retain the safe conditions of the airfield. Other than routine maintenance, no changes to wind indicators are expected during the planning period.

Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights (MALSR) – The MALSR is a series of light bars located at the threshold of a runway used in assisting pilots to confirm the centerline of a runway during landing. At BIS, a FAA-owned MALSR is located at the approach end of Runway 31, while the 13 end has only a MALS. On Runway 31, the approach lighting segment intensity can be controlled by the pilot. An approach lighting system such as a MALSR is required for approach visibility minimums below 3/4 mile. As part of the upcoming Runway 13/31 rehabilitation project, the Airport is currently evaluating the feasibility of upgrading the ILS to eliminate signal reflection issues affecting some aircraft types. In consultation with FAA, the Airport elected not to replace the existing ILS. Instead, the Airport made the decision to relocate the MALSR electrical control building further west and make improvements to the existing grade for a new FAA-owned lighting system to be installed during the spring of 2017. The combination of grading, relocation of the MALSR building, and the installation of a new approach lighting system will eliminate the present-day ILS signal issues for Runway end 13 and help achieve improved aircraft approach minimums

Precision Approach Path Indicators – Precision Approach Path Indicators (PAPIs) provide the correct glide slope path for an aircraft approaching a runway through a series of red and white lights arranged in a single row consisting of either two- or four-light units. A combination of red and white, all red, or all white lights identifies if a pilot is on the glide slope, below the glide slope, or above the glide slope, respectively. A four-light PAPI unit is located at each end of Runways 13/31 and 3/21. The PAPIs serving the Runway 13 end are FAA-owned, while the remaining units are owned by the Airport. Upgrades to the PAPI systems on Runway 13/31 will be completed during the runway rehabilitation project. No changes to the Runway 3/21 PAPIs are foreseen at this time. Continued scheduled maintenance and inspection is recommended through the 20-year period.

Runway Edge Lighting – Runway edge lights are a vital tool for visual navigation for pilots. The edge lighting lenses are white except for the final 2,000 feet of an instrument runway where lighting changes to amber to help identify the end of the surface. Runways 13/31 and 03/21 are each equipped with a high intensity runway lighting (HIRL) system which offers five illumination intensity settings and the ability for pilots to request changes to the intensity of the lights through communications with the air traffic control tower. Since this is the highest intensity light system in use today, it is recommended that the Airport is to convert to light emitting diode (LED) lighting as lights are replaced in the future.

Airfield Pavement Markings – Airfield pavement markings applied to runways, taxiways, and apron surfaces provide visual and perceptual navigational cues to pilots and ground vehicle operators when navigating an airfield surface. Examples of pavement markings include runway markings, the boundary of a runway and its associated safety area, and the boundary of the movement area where communication with air traffic control is necessary. Runways that support precision instrument approaches are required to

include a landing designator marking, centerline, threshold markings, aiming point marking, touchdown zone markings, and side stripes. Each end of Runways 13/31 and 03/21 are painted with these precision pavement markings. Only routine maintenance is anticipated throughout the planning period to maintain the reflectivity and visibility standards so that they can be easily identified in reduced visibility and nighttime conditions.

Airfield Signage – Airfield signage is an important visual navigational aid that helps identify the locations of runways, taxiways, and aprons, as well as provide noise abatement instructions and other airfield information to pilots. Airfield signage at the Airport includes runway hold position signs, runway distance remaining signs, taxiway locations, taxiway directional signs, and destination location signs. Currently, several of the airfield signs do not meet existing airfield signage standards set forth in FAA AC 150/5340-18F, *Standards for Airport Sign Systems*. The Airport is aware of these nonstandard signs and will install new FAA compliant signs during the Runway 13/31 rehabilitation project. Once the new signs have been installed, the Airport will continue to conduct routine inspections, maintenance, and periodic replacement to ensure signs continue meet reflectivity and visibility standards throughout the planning period.

Taxiway Edge Lighting – Taxiway edge lighting is similar to runway edge lighting in that it is an important navigational tool for pilots and ground vehicle operators. It helps to identify the edge of a taxiway surface when visibility conditions are limited, such as during the night and in inclement weather. The taxiway edge lighting installed are a medium intensity taxiway lighting (MITL) systems, offering three illumination intensities. The entire airfield is equipped with a MITL system, and no improvements are necessary; however, during routine maintenance and projects, the Airport should convert the lighting to LED as funding allows.

3.7.2 Electronic Navigational Aids

Electronic NAVAIDs are important navigational tools in that they allow properly equipped aircraft to conduct landings when conditions impact the ability of a pilot to visually navigate a landing into an airport with low cloud ceilings, night conditions, or inclement weather. Electronic NAVAIDs range from signal transmitting devices installed at an Airport to off-airport electronic equipment and satellites orbiting in space. The following section explains electronic NAVAIDs that are utilized for aircraft landings at the Airport.

Instrument Landing System – An ILS comprises two components: a localizer and a glide slope antenna. The localizer is an antenna placed at the departure end of a runway that transmits a signal to align aircraft with the centerline of a runway when on approach to land. The glide slope antenna is positioned near the aiming point marking at the approach end of a runway and provides vertical guidance to aircraft to align them with the correct landing decent path. ILSs permit properly equipped aircraft with certified pilots to conduct precision instrument approaches during periods of limited visibility.

The type of precision instrument approach offered by an ILS is categorized based on the minimum cloud ceiling height and visibility requirement that is necessary for a pilot to fly the approach, with Category III approaches offering lower decision heights and visibility requirements than Category I approaches. The Airport is equipped with a FAA-owned Category I ILS approach to Runways 13 and 31. As part of the Runway 13/31 rehabilitation project, the Airport is evaluating the feasibility of upgrading the existing ILS system with a newer, more technologically advanced, system which will eliminate current signal reflection issues affecting some aircraft types upon approach. The existing ILS can serve the Airport throughout the 20-year planning period should the Airport decide not to upgrade the ILS as part of the runway rehabilitation project.

The Airport's crosswind, Runway 3/21, is not equipped with a precision approach at this time. This is potentially significant since during Instrument Flight Rules (IFR) conditions, Runway 3 provides the greatest wind coverage at all crosswind components. This would provide a reasonable amount of justification for increasing the instrument capabilities of the Runway 3 end. Currently, Runway 3 has a localizer performance with vertical guidance (LPV) approach with minimums as low as ¾ statute mile. Since the FAA is moving away from ground-based instrumentation to provide precision instrument approaches, in support of satellite based "NextGen" navigation initiatives, legacy systems such as ILSs are not being installed. However, for an airport to receive a satellite-based precision instrument approach minimum, other infrastructure components such as an approach lighting system will still be required. Therefore, it is recommended that the Airport consider installation of an approach lighting system such a MALSF to Runway 3. With this system, the runway would be properly equipped to receive approach minimums as low as a Category I ILS.

Global Positioning System – Global Positioning System (GPS) is a satellite-based navigational system that transmits signals to properly equipped aircraft so that location altitude, direction, and speed can be determined. Currently, BIS has four published satellite-based instrument approach procedures. All four of these approaches offer LPV, which allows high-accuracy approaches with minimums as low as one half mile. These approaches each offer properly trained pilots the ability to conduct a GPS-based approach when the visibility is at its lowest and receive vertical and horizontal guidance. The GPS approaches to BIS's runways appear adequate to meet the demands of users throughout the planning period. If more advanced approach lighting were installed on another runway end, there might be an opportunity to reduce minimums in the future.

Very High Frequency Omni-Directional Radio Range Antenna – The Very High Frequency Omni-Directional Radio Range antenna, also known as a VOR, is a ground based NAVAID that emits radio signals so that a pilot can determine his or her course and position in relation to the distance from the VOR. While no VOR is located on Airport property, a FAA-owned VOR is installed approximately 2.9 miles from Runway 31 and has published non-precision circling approaches to all runways. VORs do not offer the accuracy of GPS, and the FAA is currently evaluating the necessity, benefits, and costs of these NAVAIDs throughout the National Airspace System (NAS). No changes are anticipated to the VOR during the planning period.

Airport Weather Observation System – Weather observation equipment is installed on airfields to disseminate accurate and timely weather conditions to pilots on the ground and en route aircraft. At the Airport, an ASOS unit, owned by the National Weather Service, is located adjacent to the Runway 13 PAPI, approximately 1,100 feet from the approach end of the runway. The existing ASOS unit installed at the Airport meets the accuracy of weather reporting required for aircraft to conduct Category I precision instrument approaches and does not need to be replaced with a system offering more weather reporting accuracy to meet the demands of users within the planning period. An existing FAA-owned RVR station is located at the North end of the airport and is aligned with Runway 31. The presence of RVR equipment increases the accuracy of visibility measurements during low visibility conditions, and aids pilots in making more informed decisions. The existing RVR equipment located at BIS is anticipated to meet the future needs of the Airport throughout the 20-year planning period. If the Airport upgrades the ILS system to achieve Category II approach capabilities, the existing weather observation equipment will also need to be upgraded to support Category II requirements.

3.8 TERMINAL AREA

In addition to airside elements, a review of the facility needs in the terminal area was also conducted as a part of this master plan study. The terminal area is shown in **Exhibit 3-14**. Terminal area elements assessed include the terminal gates and apron, terminal building, landside vehicular access, and vehicle parking, and that is how they are organized in the following sections:

- Terminal Apron and Gate Requirements
- Terminal Building Requirements
- Landside Access Requirements
- Terminal Area Vehicle Parking Requirements

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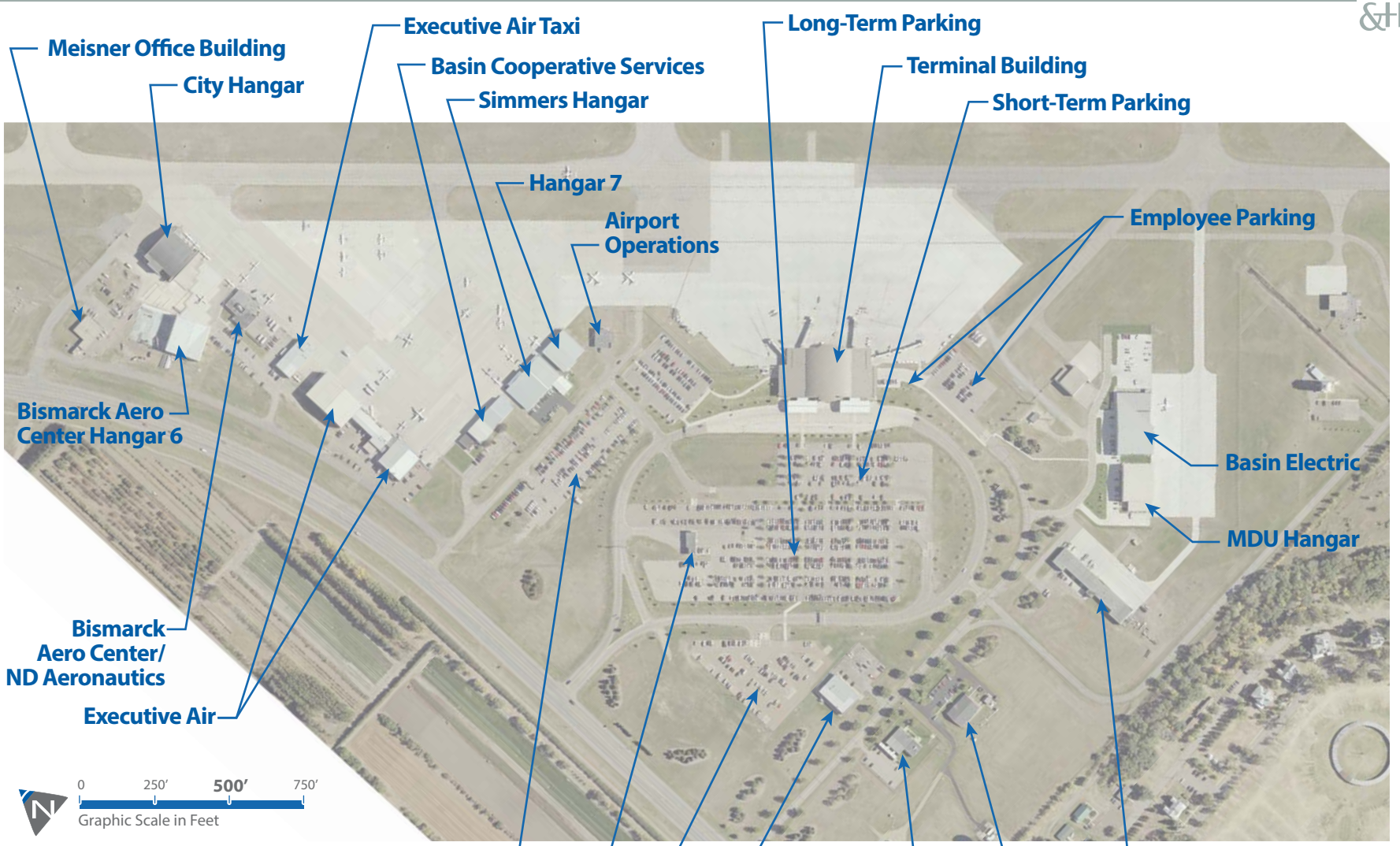

Exhibit 3-14 **Terminal Area**

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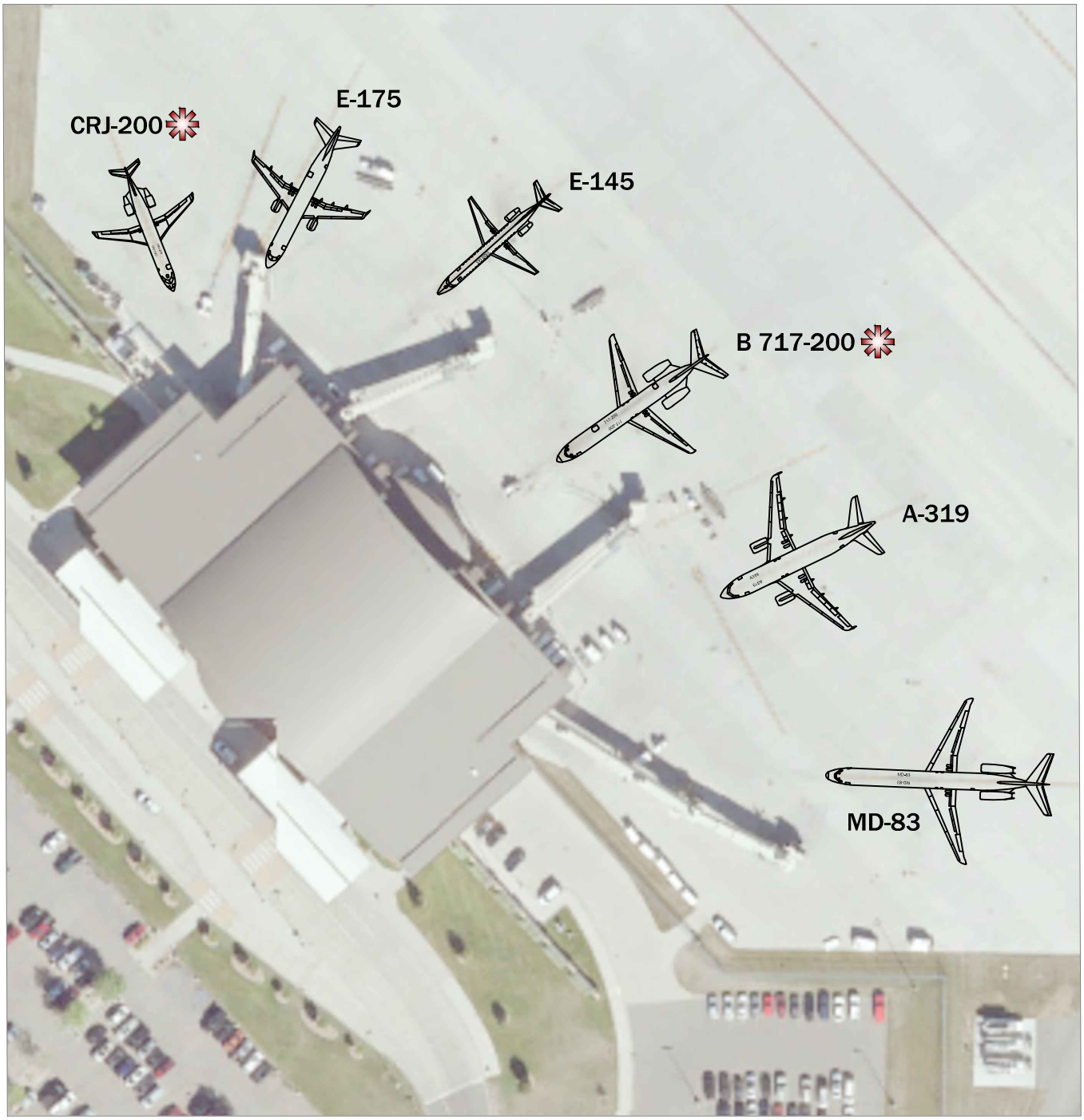


Space also used for remaining overnight aircraft.

N

0' 100' 200'

Bismarck AIRPORT Master Plan Update

Exhibit 3-15 **Terminal Apron**

3.8.1 Terminal Apron and Gate Requirements

The number of gates needed to support forecasted activity is a critical element in determining the overall size and configuration of the terminal complex. A gate is defined as an aircraft parking position near the terminal that is used daily for the loading and unloading of passengers. The Airport currently has four gate positions, each served with a passenger boarding bridge. There are also additional aircraft parking positions around the perimeter of the apron to accommodate deicing operations and parking of aircraft near the terminal building. **Exhibit 3-15** depicts the passenger terminal building and aircraft parking apron.

3.8.2 Passenger Terminal Building

The 78,000 square foot terminal building space at the Airport consists of four boarding gates, four passenger boarding bridges, two baggage claim devices, a single security checkpoint equipped with three X-ray screening lanes, airline and rental car spaces, Transportation Security Administration (TSA) offices, concessions spaces, and other ancillary spaces. While this master plan study does not include a detailed space programming study of the individual components within the terminal building facility, but it does include an assessment and planning for overall gross terminal building space needs.

This BIS passenger terminal building was constructed in 2005 and was designed to meet the anticipated level of future demand estimated in the previous 2003 airport master plan. Since that time, a number of changes have occurred in the aviation industry including the initial phase out of the 50-seat regional jet, the increased use of larger narrow body aircraft, and the growth of low and ultra-low-cost airlines operating from BIS. Additionally, the continued evolution of TSA requirements within the terminal and the continued

increase in passengers have resulted in a need for increased space throughout the terminal building. The existing Security Check Point often becomes highly congested during peak activity periods causing a backup of passengers extending down the stairs to the ticket lobby. As a result, the Airport implemented a third screening lane in November 2016 to help alleviate some of the congestion during the busiest times of the day. In 2017, the Airport plans to install additional floor space in the upper terminal level in front of the TSA Security Check Point and begin design on a project which will further widen the exit lane out to the stairwell/escalators. This project will provide additional floor space room for queuing lines leading into the future TSA Security Check Point. The addition will reduce expansion and enable passengers to exit the departure gates more quickly thereby reducing congestion during peak periods.

As noted in Chapter One, the BIS passenger terminal is a two-level structure oriented in a simple linear configuration. The total size of the terminal building consists of approximately 78,000SF. In order to accommodate the estimated level of future aviation activity, the passenger terminal building will need to expand in size. For the purposes of determining future terminal capacity, Airport Cooperative Research Program (ACRP) Report 25: Airport Passenger Terminal Planning Volume 1 was used for gross terminal planning calculations. Report 25 recommends that gross planning area standards for small domestic airports be identified using a ratio of square footage per narrow body gate, otherwise known as Narrow Body Gate Equivalent (NBGE). This methodology is top down approach for determining a general range of square feet per future passenger enplanements (Ep). Based on the 2035 forecast of future passenger enplanements (431,961), the following calculation was applied for two ranges, low and high.

Small Domestic Airports

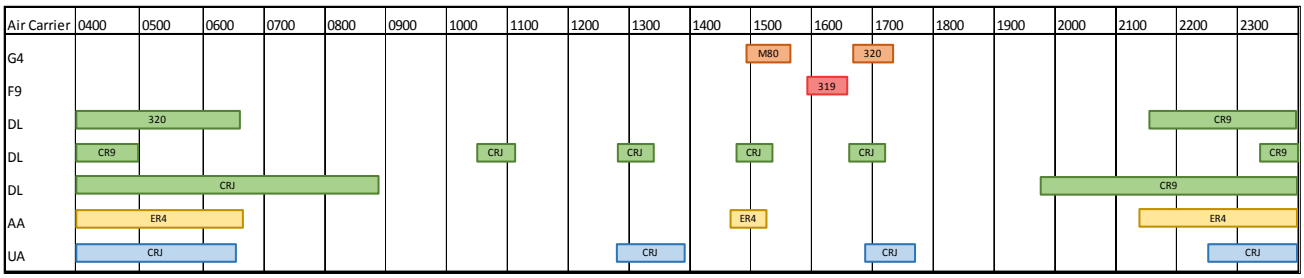
Low Range -15,000SF per NBEG X 120,000SF/431,961 Eps (2035) = 0.28SF per Ep

High Range -15,000SF per NBEG X 144,000SF/431,961 Eps (2035) = 0.33SF per Ep

Based on the assumptions identified in Chapter Two, it is assumed that narrow body aircraft will continue to be the primary airframe to serve BIS throughout the 20-year planning period. As a result, a planning ratio of 0.30SF per Ep was used to determine future gross terminal area square footage needed to adequately serve future passengers. The selection of 0.30SF per Ep fell within the low and high range noted above. Applying the calculation, an estimate of 128,000SF of total terminal area is recommended by 2035. From its current size of approximately 78,000SF, the terminal would need to expand by an additional 50,000SF by 2035. This estimate includes space for both terminal levels one and two and includes additional administrative and support space over the 20-year planning period. The exact size of the terminal expansion may vary based on the individual needs of the Airport and available funding. The purpose of this recommendation is to identify a general estimate based on future space recommendations.

Terminal Apron - The size of the terminal apron should be able to accommodate the fleet mix of commercial aircraft types present during periods where the demand for space is at its greatest. **Exhibit 3-16** depicts the airline schedule of the peak month (December 2015) as a ramp chart by carrier. This ramp chart shows a bar for the arrival and departure time of each passenger aircraft at the Airport indicating when a gate or parking position at the terminal is occupied.

Exhibit 3-16: Air Carrier Ramp Chart



Source: Mead & Hunt, 2016.

The greatest demand for terminal gate and apron space occurs during the overnight period when aircraft from the final arriving flights of the day are parked and staged for departure the following morning, also known as remain overnight aircraft (RON). RON aircraft parking during the peak month of December is presented in the air carrier ramp chart (Exhibit 3-10). As shown, airlines schedules include five overnight aircraft with an additional aircraft parking space located near Gate 1. It should also be noted that the above exhibit is an example of a single day and peak hours may fluctuate the gate demand remains the same. The Airport experiences variations in airline flight schedules that alter the air carrier ramp chart and overnight parking demands shown in **Table 3-25**. The Airport also experiences occasional RON charter flights that are not included in the ramp chart of scheduled passenger activity.

The forecasted demand for RON aircraft parking on the terminal apron through 2035 is presented in Table 3-25. It is assumed that the total number of typical daily departures is directly proportional to the total number of annual scheduled passenger aircraft departures. Using the demand for RON aircraft parking on a typical Sunday in the peak month of December 2015 as a benchmark, the projected demand for RON aircraft parking by aircraft type was extrapolated from the projected typical daily departures.

Table 3-25: Projected Overnight Aircraft Parking Demand					
Year	Current	Projected			
	2015	2020	2025	2030	2035
Annual Enplanements:	259,734	296,308	341,525	386,743	431,961
Total Annual Scheduled Passenger Aircraft Departures:	4,639	4,944	5,476	5,959	6,396
Peak Month Typical Day (PMTD) Departures:	13	14	15	17	18
Overnight Aircraft Parking Demand:	5	5.3	5.9	6.4	6.9
Percent of Total Average Daily Departures:	38.5%	38.5%	38.5%	38.5%	38.5%

Source: Diio Mi Airline Schedules, Mead & Hunt, Inc. (2016)

As illustrated in the Table 3-25, the total number of daily flights is anticipated to increase through the planning period. Likewise, the table also indicates that the number of overnight aircraft are also anticipated to increase through the planning period. Therefore, it is anticipated that daily RON aircraft in 2035 will increase to 6.9 or approximately 7 aircraft. Furthermore, it is desirable for the terminal apron to be sized to accommodate at least one or two additional aircraft beyond those projected to accommodate late arriving or departing flights, changes in airline flight schedules, charter activity, a new entrant service carrier, or aircraft diversions from other airports due to weather. Therefore, through the planning period, the Airport should plan to accommodate at least 8 to 9 aircraft parking positions for RON aircraft.

Terminal Gates – In addition to RON aircraft parking, terminal gate demand during peak activity hours was also evaluated. As noted previously, there are currently four fully functioning gates within the passenger terminal building. As was shown on the airline ramp chart, the peak gate demand outside of RON aircraft parking occurs around 16:50 (4:50 p.m.) when there are three gates used simultaneously. Also, unscheduled charter flights occasionally occur requiring gate facilities. The use of ground boarding is not desirable during winter months, therefore, each of the existing four gates are used year-

round. Currently, these four gates can accommodate the existing passenger demand; however, the anticipated increase in passenger enplanements identified in Chapter Two indicate that additional gates will be required.

Table 3-26 illustrates the calculations used to determine the number of new aircraft gates needed by 2035. Each of these calculations are based on the peak hour (PH) forecasts identified in Chapter Two. The first calculation utilizes the percentage of peak month typical day (PMTD) activity occurring within the peak hour. The results of this calculation indicate that the approximately 27.5 percent of 2015 total average daily departures occur during the peak hour. If held constant throughout the 20-year planning period, a total of 4.9 (rounded up to 5) gates are needed to accommodate the 2035 forecast of passenger enplanements (431,961Eps). The second calculation shown in Table 3-26 examines the number of total annual enplanements occurring per gate. In 2016, it is estimated that the Airport will accommodate 64,934 enplanements per gate. Assuming a similar level of passenger activity per gate over the same 20-year period, 6.7 (rounded up to 7 gates) will be needed to accommodate the estimated 431,961 enplanements anticipated through the planning period.

Table 3-26: Projected Aircraft Gate Demand					
Year	Current	Projected			
	2015	2020	2025	2030	2035
Annual Enplanements:	259,734	296,308	341,525	386,743	431,961
Total Annual Scheduled Passenger Aircraft Departures:	4,639	4,944	5,476	5,959	6,396
Peak Month Typical Day (PMTD) Departures	13	14	15	17	18
Peak Hour Percentage					
Peak Hour Gate Demand	3.6	3.8	4.2	4.6	4.9
Percent of Total Average Daily Departures in PH:	27.5%	27.5%	27.5%	27.5%	27.5%
Annual Enplanements per Gate:	64,934	74,077	85,381	96,686	107,990
Enplanements per Gate					
Peak Hour Gate Demand	4.0	4.6	5.3	6.0	6.7
Percent of Total Average Daily Departures in PH:	27.5%	32.9%	34.3%	35.7%	37.1%
Annual Enplanements per Gate:	64,934	64,934	64,934	64,934	64,934

Source: Diio Mi Airline Schedules, Mead & Hunt, Inc. (2016)

As shown in Table 3-26, the peak gate demand is anticipated to increase through the planning period. Since airline schedules are constantly changing, it is recommended that planning be included for at least one or two additional gates beyond the projected demand to accommodate changes in airline flight schedules, late arriving or departing flights, charter activity, a new entrant service carrier, and aircraft diversions from other airports for weather or other reasons. Having a plan for additional gates and protecting additional space within the terminal area for additional gates is recommended to accommodate future growth beyond the planning period or in case passenger enplanements exceed the selected calculation.

Therefore, for terminal and space planning purposes, it is projected that the airport will have a need for a total of five or six gates through the planning period and should protect space for future gates totaling seven or eight gates. The existing terminal has four gate

parking positions and hold rooms, indicating that planning should occur for at least two additional gates and hold rooms, and space should be protected for four additional gates.

3.8.3 Landside Access

Landside vehicular access to the Airport was also reviewed. In addition to on-Airport roadways and traffic circulation, access to the Airport from major regional traffic arteries was also evaluated to determine if roadway infrastructure appear adequate. Nearby roadways are shown on **Exhibit 3-17**.

Off-Airport Access - Overall, the Airport is well situated south of Interstate 94. The Airport terminal road provides circulation through the terminal area and access to parking and other Airport facilities. The terminal road intersects with University Drive, which connects to the city center. No highway infrastructure improvements were identified within the region to further improve connectivity to the Airport.

On-Airport Access – Although the primary means of accessing the Airport is University Drive, Yegen Road connects to University Drive approximately 1.5 miles to the south and provides access to the Army Aviation Support Facility based at BIS. Yegen Road continues to circumnavigate the north, south and east sides of the Airport. Several secure gates provides access to the airfield, such as off of Lincoln Road and Sykes Drive. Secure gates provide multiple access points to the Airport for emergency personnel and tenants to access hangars and other Airport facilities. Eclipse Way provides landside access to many Airport tenants, such as the FBO, ND Aeronautics Commission, and cargo facilities. These secure access gates also provide access to the airside. Jetway Avenue and Corporate Circle, located on the south side of the terminal area, provide access to corporate hangars, the FAA ADO, and the National Weather Service. Finally, an additional access road located on the south side of the terminal provides access to the

ATCT and is equipped with gate connecting the ARFF facility to the airfield. Each of these access roads are in working order and will continued to be maintained as part of normal operations. Therefore, access to the Airport is considered both adequate and efficient; therefore, no improvements are recommended at this time.

3.8.4 Terminal Area Vehicle Parking Requirements

An evaluation of vehicle parking at the Airport was carried out to assess the needs for adequate, convenient parking throughout the planning period as passenger enplanements and facilities expand to meet demand. In addition, an evaluation of employee parking and rental car ready/return parking needs was conducted to determine if future expansion of existing vehicular parking areas will be necessary. The basis of these analyses involved benchmarking past and current relationships between parking demand and originating passenger enplanements. Therefore, future parking demand is projected by determining the current ratio of parking spaces to enplanements and maintaining that ratio as enplanements increase over time. This method allows parking projections and enplanements to grow at a similar rate to determine annual demand. Current vehicles parking areas are shown in **Exhibit 3-18**.

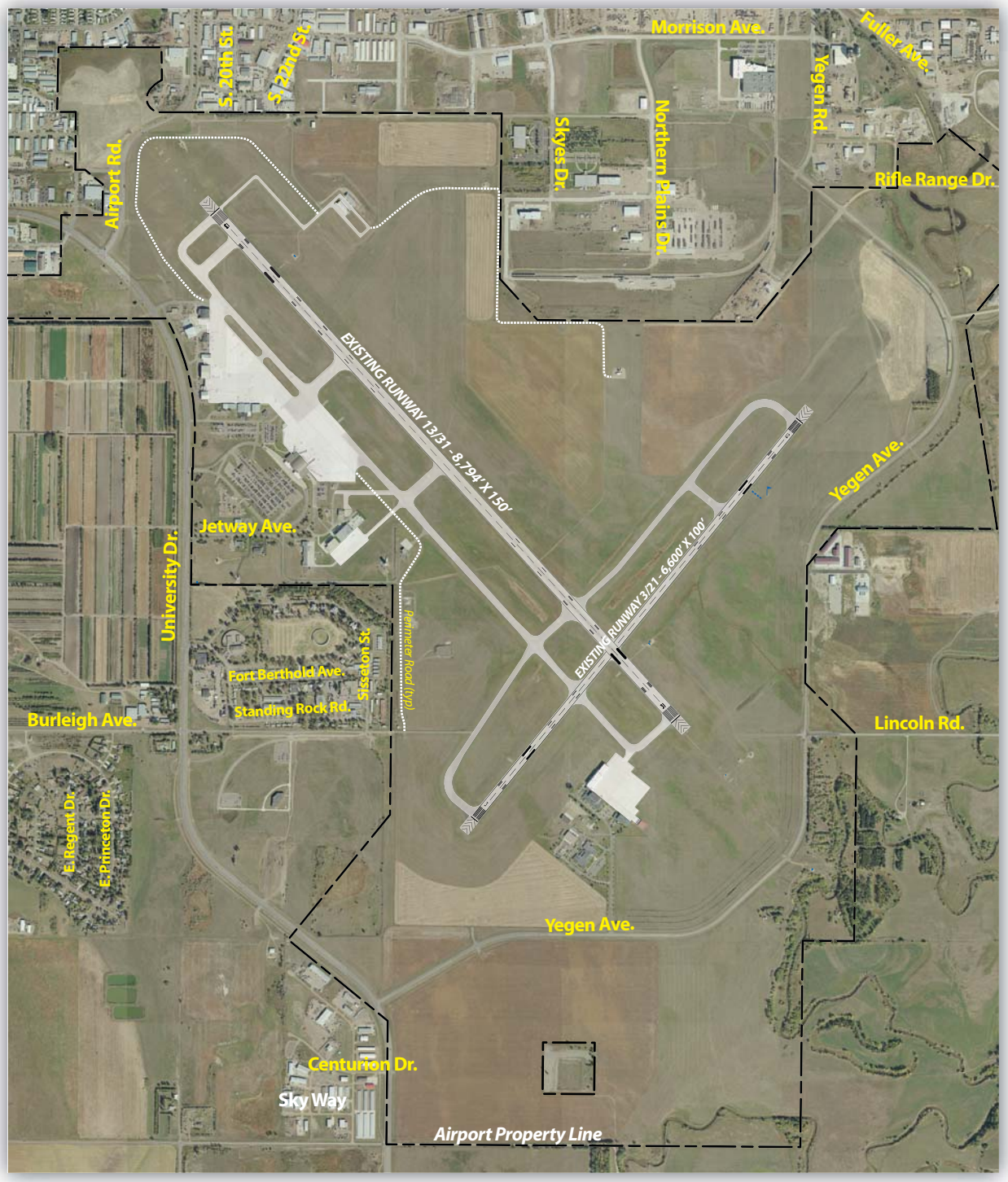


Exhibit 3-17 **Landside Roadways in Proximity to the Airport**

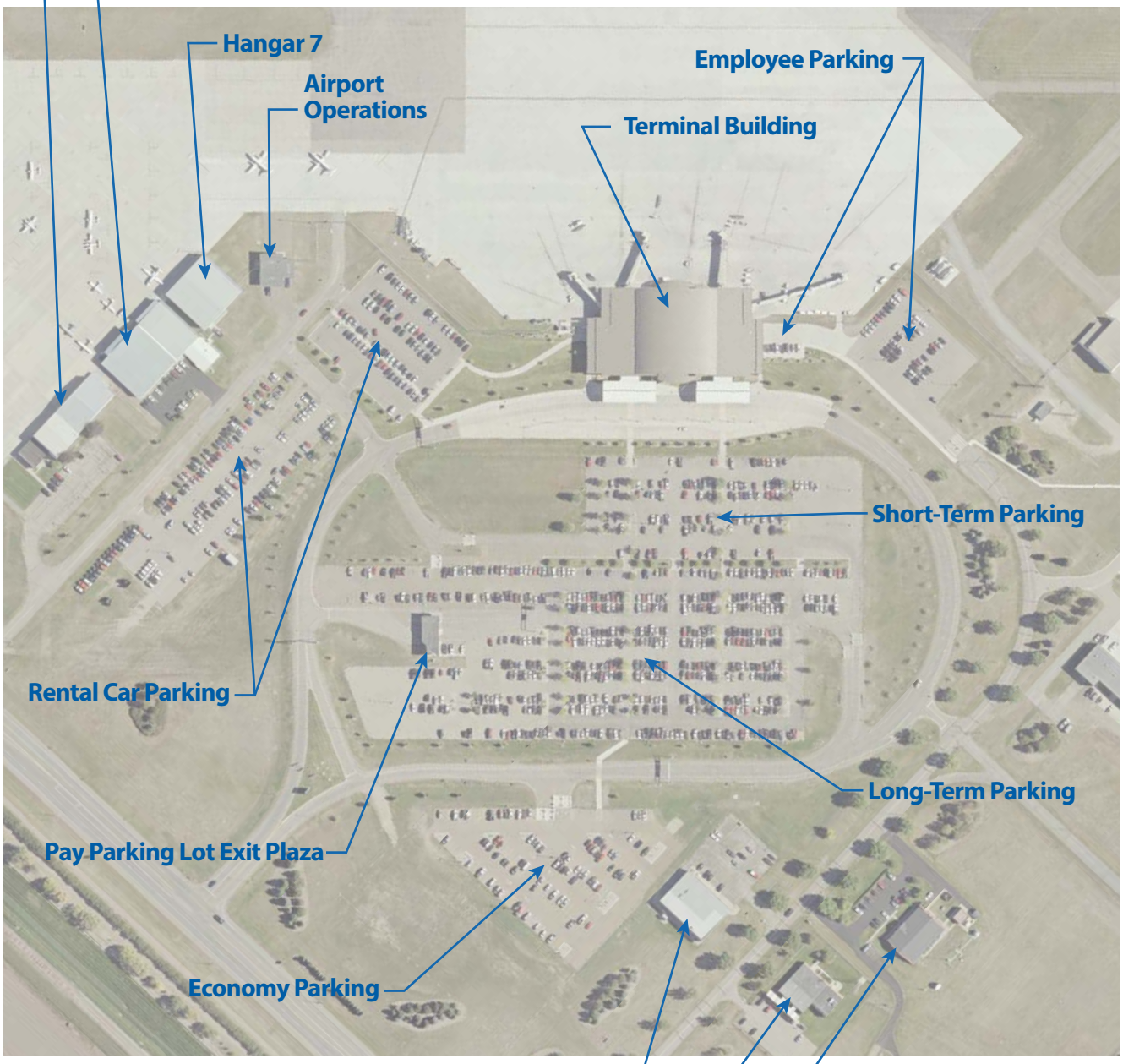


Exhibit 3-18 **Vehicle Parking**

Parking Capacity – There are currently 1,119 spaces available for public parking at BIS. These parking spaces are located west of the commercial airline terminal building and used for long term (660 spaces), economy (177 spaces), and short-term (282 spaces) parking. Other parking areas supporting terminal activities include the employee parking area (87 spaces) to the south of the terminal and the rental car parking area (435 spaces) located on the north side of the terminal building. **Table 3-27** summarizes the current parking capacity at the Airport.

Table 3-27: Terminal Area Parking Supply	
Public	
Long Term	660
Hourly	282
Economy	177
Subtotal	*1,119*
Rental	
Ready	76
Return	39
Storage	320
Subtotal	*435*
Miscellaneous	
Employee	87
FBOs	208
Other	48
Subtotal	*343*
Grand Total	**1,897**

Source: Bismarck Airport records (2015)

Public Parking Demand – Parking demand at an airport is normally expressed as a ratio of spaces required per 1,000 annual originating enplanements. Like most systems, a parking system runs most efficiently when it is at 85 percent to 95 percent capacity. The allowance of five percent to 15 percent of excess spaces allows for the dynamics of cars moving in and out, reduces search time for a space, and allows for a temporary loss of spaces due to parking lot maintenance activities, snow cover, or other unforeseen circumstances. Ideally, this cushion can also accommodate parking on days that are busier than the average or typical day. On extremely busy days, the capacity of the parking lot should be capable of meeting demand, but the cushion will be limited, and parking space search times could be greater. During the Airport's busiest travel periods including the Thanksgiving and Christmas holiday season, parking is insufficient as cars often must park in grass overflow areas adjacent to the short-term and economy parking lots. area Therefore, this parking assessment analyzes the peak parking days, so that the system can accommodate the peak parking needs, which includes an allowance of 5 to 15 percent excess capacity for average days. **Table 3-28** identifies the recommended public parking projections for the 5-, 10-, and 20-year planning periods.

Table 3-28: Public Parking Demand Projections					
Parking Demand	**Scheduled Annual Enplanements**	**Demand Ration per 1,000 Enplanements**	**Parking Demand**	**Parking Capacity**	**Surplus/ Deficiency**
Short-Term					
2015	259,734	1.09	282	282	0
Projected					
2020	296,308	1.09	323	282	-41
2025	341,525	1.09	372	282	-90
2030	386,743	1.09	422	282	-140
2035	431,961	1.09	471	282	-189
Economy					
2015	259,734	0.68	177	177	0
Projected					
2020	296,308	0.68	201	177	-24
2025	341,525	0.68	232	177	-55
2030	386,743	0.68	263	177	-86
2035	431,961	0.68	294	177	-117
Long-Term					
2015	259,734	2.54	660	660	0
Projected					
2020	296,308	2.54	753	660	-93
2025	341,525	2.54	867	660	-207
2030	386,743	2.54	982	660	-322
2035	431,961	2.54	1,097	660	-437

Source: Mead & Hunt, 2016.

It should be noted that the parking demand ratio can be measured with some precision for any year as long as the proper data is collected. However, it is not a static number, although it has been treated as such in the projections because the nature of airline passengers can change frequently over time due to several factors. For example, if enplanements on low-cost carriers comprised a larger portion of the increase in enplanements at the Airport, the parking demand may increase more quickly than enplanements due to the nature of these passengers and longer trip durations. As a result, it is recommended this calculation be checked each year to track trends and adjusted accordingly to changing parking activity.

It should also be noted that the above parking demand calculation is quantitative, not qualitative; in other words, there may be enough parking, but it may not provide the level of customer service desired by the Airport. In the future, consideration should be given to adjust parking rates, or create VIP parking areas, particularly on the most convenient parking close to the terminal.

Employee Parking Demand – Employees parking at the Airport include those from the Airport staff, TSA, car rental agencies, tenants, and airlines. Seven parking spaces are situated along the south side of the terminal building and used by Airport administration staff. A larger lot to the south with 80 spaces is used by other employees. Airport management estimates that, on peak days, these lots are basically at capacity and are full at times of high demand, such as during a shift change. This utilization was used to estimate future employee parking demand, as summarized in **Table 3-29**. A deficit of 56 spaces is anticipated by the year 2035.

Table 3-29: Employee Parking Demand Projections					
Parking Demand	**Scheduled Annual Enplanements**	**Demand Ration per 1,000 Enplanements**	**Parking Demand**	**Parking Capacity**	**Surplus/ Deficiency**
Historical					
2015	259,734	0.33	87	87	0
Projected					
2020	296,308	0.33	98	87	-11
2025	341,525	0.33	113	87	-26
2030	386,743	0.33	128	87	-41
2035	431,961	0.33	143	87	-56

Source: Mead & Hunt, 2016.

Rental Car Ready/Return and Storage Spaces – The rental car ready/return lot north of the terminal contains 435 spaces. Of these, 76 spaces are used for rental cars ready to be used for passengers, 39 spaces are for returns, and the remaining 320 spaces are for storage. Demand for ready and return spaces were projected together at a ratio of 0.44 per 1,000 enplanements. Based on this ratio, an additional 75 spaces will be needed by 2035. Storage for rental cars was determined to have a deficiency of 211 spaces by 2035, as shown in **Table 3-30**. It should be noted that a wash facility was recently added to this area for rental cars; however, the additional parking spaces built in this area have no impact on the calculation of future rental car parking demand.

Table 3-30: Rental Car Parking Demand Projections					
Parking Demand	**Scheduled Annual Enplanements**	**Demand Ration per 1,000 Enplanements**	**Parking Demand**	**Parking Capacity**	**Surplus/ Deficiency**
Ready/Return					
2015	259,734	0.44	115	115	0
Projected					
2020	296,308	0.44	130	115	-15
2025	341,525	0.44	150	115	-35
2030	386,743	0.44	170	115	-55
2035	431,961	0.44	190	115	-75
Storage					
2015	259,734	1.23	320	320	0
Projected					
2020	296,308	1.23	364	320	-44
2025	341,525	1.23	420	320	-100
2030	386,743	1.23	476	320	-156
2035	431,961	1.23	531	320	-211

Note: *Long term parking includes both long term and economy parking

Source: Mead & Hunt, 2016.

Parking Needs Summary – A summary of existing and projected parking capacity and demand throughout the planning period is presented in **Table 3-31**. Review of the table indicates that additional parking deficits will increase through 2035 for public parking, rental car ready/return parking, rental car storage, and employee parking as passenger activity levels increase. As shown in Table 3-31, without the development of additional parking capacity, parking deficits will continue to increase in all areas as passenger enplanements increase. The desired level of customer service should be considered along with the number of spaces provided as plans are developed for future parking facility needs.

Table 3-31: Parking Capacity/Demand Summary					
Airport Parking	**2015**	**2020**	**2025**	**2030**	**2035**
Public Parking					
Demand	1,119	1,277	1,472	1,667	1,862
Capacity	1,119	1,119	1,119	1,119	1,119
Difference	0	-158	-353	-548	-743
Employee Parking					
Demand	87	98	113	128	143
Capacity	87	87	87	87	87
Difference	0	-11	-26	-41	-56
Rental Ready/Return					
Demand	115	130	150	170	190
Capacity	115	115	115	115	115
Difference	0	-15	-35	-55	-75
Rental Storage					
Demand	320	364	420	476	531
Capacity	320	320	320	320	320
Difference	0	-44	-100	-156	-211
Total					
Demand	1,641	1,870	2,155	2,440	2,726
Capacity	1,641	1,641	1,641	1,641	1,641
Difference	0	-229	-514	-799	-1,085

Source: Airport Records, Mead & Hunt, 2016.

3.9 GENERAL AVIATION FACILITIES

Local and itinerant general aviation (GA) aircraft accounted for roughly 72 percent of all operations in 2015. This fact will be evaluated along with the GA facilities at the Airport, including the suitability of existing groundwork. The type and size of facilities required to accommodate GA activity has a direct relation to the size and type of GA aircraft that operate at an airport. Environmental and geographic factors such as climate, available undeveloped land, and anticipated demand also guide facility planning when reviewing GA infrastructure at an airport. This facilities review focused on major components that are presented in this section: the GA terminal buildings, services provided to GA users, and hangar space available at the Airport. This review of GA facilities also focused on the adequacy of the fuel farm to meet fuel storage requirements of the airlines as well as the air cargo facilities at the Airport.

3.9.1 General Aviation Terminal Buildings

Two GA terminal buildings serve as the focal point for all GA activity at the Airport. These two public-access terminals include the Bismarck Aero Center and Executive Air. Both serve as the transfer point for pilots and passengers of GA flights, provide administrative offices for staff, and provide space for pilots to plan flights and access weather information. These facilities are equipped with conference rooms, passenger waiting areas, crew rest areas, and reception desks that also serve as the communication centers for GA line services. Combined, both terminal buildings provide approximately 17,200 square feet of area. The GA terminals were designed to provide adequate space to meet the long-term demands of public circulation, waiting area space, administrative areas, flight planning/conference room space, and utility/storage areas. It is recommended that future airport planning keep in mind expansion needs of the GA terminal buildings and associated facilities so that these areas continue to meet the demands of the users.

3.9.2 Fixed Base Operator Services

Fixed base operator (FBO) services are those that support GA activity, such as fueling, aircraft maintenance and repair, and coordination of ground transportation for itinerant users. FBO services currently being provided at the Airport include 100 low lead (LL) and Jet-A aviation fuels, flight training, charter services, airframe and avionics maintenance and repair services for single- and multi- engine aircraft, power plant maintenance and repair, and line service personnel available to marshal taxiing aircraft and assist in other ground service aircraft needs. It should be noted that the Airport places an emphasis on providing a high level of customer service when providing FBO services to GA users at the Airport; as such, compliments are often received by both based and itinerant users for the friendliness of Airport staff and the efficiency in which FBO requests are handled. While it appears that the FBO services currently being provided at the Airport will meet the needs of based and itinerant users throughout the planning period, it is recommended

that the Airport continue to place a focus on efficiency, quality, and courteousness when providing its FBO services to customers.

3.9.3 Hangars

Due to the local weather extremes throughout the year, it is assumed that all based aircraft will desire hangar storage when evaluating the capacity of existing hangars to meet future demand. Forecasts presented in Chapter Two project the number of based aircraft by fleet mix that can be anticipated at the Airport during the planning period. As summarized in **Table 3-32**, based aircraft are anticipated to grow from a total of 117 aircraft in 2015 to 133 aircraft by 2035. This equates to five additional single-engine aircraft, two additional multi-engine aircraft, six turbine aircraft, one large jet, and one additional helicopter.

Table 3-32: Projections of Based Aircraft by Fleet Mix

Year	Single Engine	Multi Engine	Turbine	Jet Aircraft	Other	Helicopters
2015	65	20	10	2	17	3
2020	66	20	11	2	17	3
2025	67	21	13	2	17	4
2030	68	21	15	3	17	4
2035	70	22	16	3	17	4

Source: Mead & Hunt, Inc. (2016)

Given the projected number of based aircraft by fleet mix that can be anticipated throughout the planning period, the demand for box-style and T-style hangars by square feet can be estimated. **Table 3-33** summarizes the approximate parking area in square feet needed to park each type of aircraft fleet mix classification. It should be noted that the amount of area required to park an aircraft varies based on the size and type of aircraft; as a result, planning ratios were used for each fleet mix classification as identified

in the Table 3-33. The size approximations for each aircraft classification included a safety margin for wingtip, nose, and tail clearances.

Table 3-33: Parking Area Sizes for Aircraft Fleet Mix Classifications		
Aircraft Type	**Examples**	**Approximate Square Feet**
Single-Engine	Cessna 172, Cirrus SR-22	1,400 square feet
Multi-Engine	Piper Seneca, Beechcraft King Air	2,500 square feet
Small & Mid-Sized Jets	Cessna Citation, Learjet	3,600 square feet
Large Business Jets	Gulfstream G550, Global Express	10,000 square feet
Helicopter	Sikorsky S-76, Bell 206	1,400 square feet
Other	Experimental, UAV, etc.	1,000 square feet

Source: Mead & Hunt, Inc. (2016)

Table 3-34 illustrates the total demand in square feet for hangar space by aircraft fleet mix classification that can be anticipated at the Airport through 2035. As the table shows, the total demand for hangar space will grow by approximately 22 percent throughout the planning period with turbine aircraft requiring an additional 34,000 square feet of hangar space followed by single-engine aircraft (6,000 square feet) and multi-engine aircraft (5,000 square feet). It should be noted that the hangar space demand for single- and multi-engine aircraft should be considered by square feet and the number of T-hangar units needed to house each aircraft.

Table 3-34: Projected Hangar Area Demand by Aircraft Fleet Mix Classification					
	2015	**2020**	**2025**	**2030**	**2035**
Single-Engine					
Projected Based Aircraft	65	66	67	68	70
Approximate Area per Aircraft	1,400	1,400	1,400	1,400	1,400
Total Demand	**91,000**	**92,302**	**93,956**	**95,639**	**97,353**
Multi-Engine					
Projected Based Aircraft	20	20	21	21	22
Approximate Area per Aircraft	2,500	2,500	2,500	2,500	2,500
Total Demand	**50,000**	**51,200**	**51,903**	**52,993**	**55,243**
Small and Medium Turbine Aircraft					
Projected Based Aircraft	10	11	13	15	16
Approximate Area per Aircraft	3,600	3,600	3,600	3,600	3,600
Total Demand	**36,000**	**40,757**	**46,171**	**52,332**	**59,348**
Large Turbine Aircraft					
Projected Based Aircraft	2	2	2	3	3
Approximate Area per Aircraft	10,000	10,000	10,000	10,000	10,000
Total Demand	**20,000**	**22,338**	**24,950**	**27,866**	**31,124**
Helicopters					
Projected Based Aircraft	3	3	4	4	4
Approximate Area per Aircraft	1,400	1,400	1,400	1,400	1,400
Total Demand	**4,200**	**4,763**	**5,402**	**5,996**	**6,103**
Military					
Projected Based Aircraft	17	17	17	17	17
Approximate Area per Aircraft	1,000	1,000	1,000	1,000	1,000
Total Demand	**17,000**	**17,000**	**17,000**	**17,000**	**17,000**
Total Demand	**218,200**	**228,361**	**239,382**	**251,827**	**266,172**

Source: Mead & Hunt, Inc. (2015)

A summary of the existing hangar capacity at the Airport is presented in **Table 3-35**. As illustrated in the table, a total of 139,200 square feet of hangar space is available to park based aircraft by means of 12 hangar structures with varying numbers of units that offer 17 hangar units for single- and multi-engine aircraft.

Table 3-35: Existing Hangar Capacity for Based Aircraft			
Hangar	**Number of Structures**	**Number of Units for Aircraft Parking**	**Total Approximate Sq. Ft. Available**
Box	12	17	139,200
Total	**12**	**17**	**139,200**

Notes: The number of available aircraft parking positions within each unit varies based on size of aircraft
Source: Mead & Hunt, Inc. (2016)

Table 3-36 illustrates the demand for projected hangar capacity at the Airport for the planning period. As illustrated in the table, an additional 109,300 square feet of box-style hangar area and 63,000 square feet of additional T-hangar units are recommended by 2033. It should be noted that the future demand for box-style hangar space includes what would be needed to house multi-engine, jets, and helicopter aircraft while the demand for T-style hangar space only includes single-engine aircraft. The size and type of projected hangar needs are generalized, and it is recommended that the Airport plan for a variety of sizes and types to accommodate various types of users as demand materializes.

It is recommended that construction of any new T-style hangar units should be to a width greater than 41 feet, 6 inches and a height greater than 12 feet. This will allow dedicated parking for larger single-engine and smaller twin-engine aircraft, better utilizing existing and future box-style hangars for larger twin-engine and jet aircraft.

Table 3-36: Projected Hangar Capacity				
Hangar Style	**2018**	**2023**	**2028**	**2033**
Box-Style				
Projected Demand	235,865 sq. ft.	259,165 sq. ft.	283,865 sq. ft.	311,065 sq. ft.
Available Capacity	201,765 sq. ft.	201,765 sq. ft.	201,765 sq. ft.	201,765 sq. ft.
Surplus/Deficit	- 34,100 sq. ft.	- 57,400 sq. ft.	- 82,100 sq. ft.	- 109,300 sq. ft.
T-Style				
Projected Demand	77,984 sq. ft. (59)	94,784 sq. ft. (67)	114,384 sq. ft. (77)	133,984 sq. ft. (87)
Available Capacity	70,984 sq. ft. (55)	70,984 sq. ft. (55)	70,984 sq. ft. (55)	70,984 sq. ft. (55)
Surplus/Deficit	- 7,000 sq. ft. (4)	- 23,800 sq. ft. (12)	- 43,400 sq. ft. (22)	- 63,000 sq. ft. (32)

Projections: Mead & Hunt, Inc. (2016)

3.9.4 Aircraft Fuel Storage Facilities

There is one fuel storage area at Bismarck, 2,500 feet west of the runway intersection, which is separated into two main storage sites, each of which are owned by their respective FBOs. The north portion consists of one 500-gallon diesel fuel tank, two 15,000-gallon Jet-A fuel tanks, and one 15,000-gallon 100 low lead (100LL) tank, owned by EATC. The south portion consists of three Jet-A fuel tanks totaling 52,000 gallons, one 17,000-gallon 100LL tank, and one 500-gallon diesel tank, owned by BAC. Combined, these facilities offer the Airport the capability to store 82,000 gallons of Jet-A fuel, 32,000 gallons of 100LL aviation fuel, and 1,000 gallons of diesel.

To evaluate the aircraft fuel storage requirements of the Airport throughout the planning period, it is first important to review the historical sale of fuel to establish a baseline of demand. **Table 3-37** illustrates the annual fuel sales at the Airport from 2011 to 2015. As illustrated in the table, an average of approximately 3,992,900 gallons of Jet-A fuel and 132,060 gallons of 100LL fuel have be sold annually between 2011 and 2015.

Table 3-37: Fuel Sales by Year (2011-2015, in gallons)				
Year	**Airline Jet-A Sales**	**General Aviation Jet-A Sales**	**100LL Sales**	**TOTAL SALES**
2011	2,718,488	896,815	121,028.9	**3,772,974.4**
2012	2,890,202	1,020,033	139,520.1	**4,084,352.2**
2013	2,890,536	1,030,413	147,836.4	**4,110,506.5**
2014	3,018,029	1,249,075	128,078.2	**4,550,312.6**
2015	2,994,848	1,256,081	123,850.3	**4,895,740.4**
'11-'15 Average	***2,902,420.6***	***1,090,483.4***	***132,062.78***	***4,282,777.22***

Source: Bismarck Airport records (2015)

Next, the fuel storage turnover rate, or the rate at which the fuel tanks at the Airport need to be refilled to meet demand, must be calculated. This rate can be calculated by dividing the annual sale of fuel by the number of days in a year to find the average daily fuel sales. The total fuel storage capacity at the Airport is then divided by the average daily fuel sales to determine the average fuel storage turnover rate. **Table 3-38** presents the findings of the historical fuel storage turnover rate for Jet-A fuel while **Table 3-39** presents the historical fuel storage turnover rate for 100LL fuel.

Table 3-38: Historical Jet-A Fuel Storage Turnover Rate (in gallons)				
Year	**Total Jet-A Sales**	**Average Daily Fuel Sales**	**Total Jet-A Fuel Storage Capacity**	**Average Fuel Storage Turnover Rate**
2011	3,615,303	9,905	82,000	**8.2 days**
2012	3,910,235	10,713	82,000	**7.6 days**
2013	3,920,949	10,742	82,000	**7.6 days**
2014	4,267,104	11,690	82,000	**7.0 days**
2015	4,250,929	11,646	82,000	**7.0 days**
'11-'15 Average	***3,992,904***	***10,939***	***82,000***	***7.5 days***

Source: Mead & Hunt, Inc. (2016)

Table 3-39: Historical 100LL Fuel Storage Turnover Rate (in gallons)				
Year	**Total 100LL Sales**	**Average Daily Fuel Sales**	**Total 100LL Fuel Storage Capacity**	**Average Fuel Storage Turnover Rate**
2011	121,028.9	331.5	32,000	**96.5 days**
2012	139,520.1	382.2	32,000	**83.7 days**
2013	147,836.4	405.0	32,000	**79.0 days**
2014	128,078.2	350.9	32,000	**91.2 days**
2015	123,850.3	339.3	32,000	**94.3 days**
'11-'15 Average	***132,062.78***	***361.8***	***32,000***	***88.4 days***

Source: Mead & Hunt, Inc. (2016)

As illustrated, the storage capacity of existing fuel tanks at the Airport can store, on average, a seven-day supply of Jet-A fuel and an 88-day supply of 100LL fuel. Airport fuel sales could increase if more long-range, non-stop routes, such as those to destinations in the Southeast and Southwest, are implemented from the Airport. Increases in operations by larger aircraft and longer-range non-stop routes, as projected to occur during the planning period, will increase the fuel storage turnover rate and thus may require an expansion of fuel storage facilities. Overall, the Airport's trend in fuel sales closely follows operational trends in the general aviation industry. It is recommended that initial planning be scheduled to prepare for an expansion of fuel storage facilities at the Airport.

3.9.5 Air Cargo

As discussed in Chapter Two, the recent decline in the oil boom and has directly affected all aspects of cargo activity. Therefore, two forecasts were prepared, one with the resumption of the oil boom and a baseline forecast that does not forecast oil boom activity resuming.

The baseline forecast was selected as the preferred forecast and is shown below:

- 7.9 million pounds in 2015
- 8.1 million pounds in 2020
- 8.3 million pounds in 2025
- 8.5 million pounds in 2030
- 8.7 million pounds in 2035

The dynamic of local BIS industries means that there is not the demand to ship small high value items that would foster the departure of air cargo. During normal cargo operations, non-oil boom, approximately 70 percent of cargo at BIS was arriving. During the oil boom this increased to approximately 75 percent. This disparity, combined with the modest forecast in cargo operations for the planning period, means that only minimal addition to cargo facilities should be required. The preservation of adequate space for air cargo operations, ground service equipment storage and maintenance, sortation facilities, and truck and auto parking should be maintained.

3.10 SUPPORT FACILITIES

Infrastructure components that are necessary to support the operation and maintenance of the Airport are support facilities. A review of these facilities including the fire station, snow removal equipment building, and operations building containing the airfield electrical vault and generator was conducted as a part of evaluating the adequacy of existing infrastructure to meet future demand. This section reviews each support facility element and discusses improvements that will be needed, if any, to meet the forecasted level of demand.

3.10.1 Aircraft Rescue and Fire Fighting Facility

The existing 6,500 square feet Aircraft Rescue and Fire Fighting (ARFF) facility at Bismarck Airport is located southeast of the terminal building, adjacent to Taxiway C. The

current configuration is satisfactory in scope to meet the current vehicle and firefighting equipment storage needs of the Airport. The current ARFF Index (Index B) meets all the facilities and storage requirements the Airport is likely to require well into the future. However, due to increasing vehicle sizes, the building may not support all desired equipment in the future. A new 3,000-gallon truck will not fit within the current configuration due to width and length restrictions, so consideration for this should be made when planning for future expansion. Many airports around the country have consolidated ARFF capabilities into less vehicles, such as the Oshkosh Strikers. This combined approach allows increased capability with minimal crew requirements. As such, it is anticipated that additional ARFF facilities may be required during the planning period, even without a significant change to the ARFF index levels. The facility is currently capable of Index C requirements if necessary.

Upon evaluation of the existing ARFF facility, the following requisites were identified to support the firefighting operations at the Airport.

- **ARFF Index –** It is anticipated that the ARFF Index at the Airport will remain at Class I Index B throughout the planning period based on the fleet mix of commercial aircraft types that are projected to operate at the Airport; however, they are capable of Index C if needed. It is recommended that the ARFF facility remain capable of supporting these Index C requirements, unless the aircraft operating from the Airport prompt a permanent change earlier.
- **ARFF Vehicles –** Bismarck Airport's three trucks, command vehicle, and foam trailer are all in good condition. One of the trucks, a 3,000-gallon Oshkosh, is slated for replacement around year 2020.
- **Personnel Areas –** The firefighting staff at the ARFF facility has access to support areas such as restroom and shower facilities, a training room, fitness area, kitchen/break area, and office space. These spaces allow the facility to

be able to accommodate firefighters for the duration of their shifts, which can be multiple days in length. No immediate needs in the personnel areas have been identified for the planning period.

- **Equipment and Raw Material Storage –** In addition to the three vehicle bays and personnel areas, additional storage areas comprise the rest of the ARFF facility. As identified in FAA AC 150/5210-15A, *Aircraft Rescue and Firefighting Station Building Design*, these storage areas accommodate firefighting turnout gear, first aid medical equipment, surplus equipment, supplies, rescue tools, self-contained breathing apparatuses (SCBA), and raw material firefighting agents such as chemicals and powders. These areas are sufficiently sized to store and move the equipment and materials in an effectual manner.

3.10.2 Snow Removal Equipment Facility

The Airport's existing snow removal equipment (SRE) facility does not currently provide adequate areas for Airport maintenance personnel and storage of equipment. The Airport is tasked with swapping equipment in and out of heated storage to make room for the implements needed to combat the current conditions. This creates an inefficient workflow, as well as increased safety concerns of trying to put more equipment into an area designed for a much lower capacity. The current SRE buildings are currently over capacity. Therefore, it is recommended that the Airport plan for an expansion of the SRE building/s to relieve overcrowding of the current facility, as well as room for additional equipment. The actual size of a future SRE expansion at BIS should be based on the size, type and function of the equipment needed for snow removal over the next 20-year period. It is recommended that the Airport consultant with maintenance personnel to identify specific equipment and spacing needs prior to beginning preliminary design.

3.10.3 Operations Building/Airfield Electrical Vault and Generator

There are two airfield electrical vaults located at BIS, one located south near the intersection of Runway 13/31 and Runway 3/21 and the other located to the north adjacent to the rental car parking area. Airfield electrical vaults are structures designed to house transformers, lighting panels, CCRs, relays, and other electrical components. Since many of the electrical components inside the vault have been upgraded and installed as airfield lights have been upgraded, it is not anticipated that improvements to the vault or generator will be needed to meet the electrical demands of airfield components during the planning period. It is recommended that any future airfield lighting projects at the Airport consider the components of the vault so major upgrade costs can be avoided if possible. The electrical vault structure located to the north also houses a centralized location for operations staff. Both electrical vaults are relatively new, and are adequate in size to sustain these duties throughout the 20-year planning period. If staff numbers increase, the accommodations within the northern vault/operations building should be reevaluated for size at that time.

3.10.4 Collection, Treatment, and Disposal of Deicing Fluids

The application of deicing fluids on aircraft is a necessary and important flight preparation procedure during the winter season to remove and prevent snow, ice, and frost from interfering with the aerodynamic surfaces of an aircraft. However, deicing fluids biodegrade rapidly, which can cause depletion of dissolved oxygen in streams that receive deicing runoff. As a result, measures need to be taken to properly collect and dispose of spent deicing fluids in order to not adversely impact the water quality of streams, rivers, lakes, and other bodies of water.

Aircraft Deicing Operations

Aircraft are currently deiced at two locations on the airport, the Terminal Apron and GA aprons. The majority of deicing is conducted at the Terminal Apron. Very infrequent aircraft deicing is conducted at the two other GA apron locations. Seasonal aircraft deicing fluid (ADF) usage in gallons of undiluted product is reported by the contractors and the FBOs that conduct deicing. Both Type I and IV propylene glycol based ADF are employed.

Regulatory Requirements

The Airport is authorized under the State of North Dakota's general industrial stormwater permit to discharge stormwater impacted by industrial activities, including deicing. Compliance with the permit requires that the Airport prepare and implement a Stormwater Pollution Prevention Plan for the following checks and balances to occur: to see that "practices are implemented to minimize the contribution of pollutants;" to conduct monitoring of deicing season stormwater discharges to assess stormwater quality against benchmark values; and to submit an annual report with the results of the monitoring and the amounts of ADF used during the year.

Development at the airport must adhere to the stormwater management requirements of both the City of Bismarck and the North Dakota Department of Health. Furthermore, FAA Advisory Circular 150/5200-33B, Hazardous Wildlife Attractants on or near Airports, states the maximum time stormwater can be detained is 48 hours. To meet these requirements, airfield drainage will be analyzed in the environmental chapter of this document. Any deficiencies will be addressed in the alternatives section. Stormwater treatment will be looked at on a regional basis to provide an efficient and cost-effective approach that does not adversely affect development and operation of the Airport.

3.11 AIRPORT TRAFFIC CONTROL TOWER

The Airport has an FAA-controlled tower that operates from 6:00am to 12:00am each day. The control tower, constructed in 1986, is maintained jointly by the FAA and the Airport Authority. Due to the age of the control tower, many of the technologies in use are outdated and some of the equipment is near the end of its useful lifespan. It would be prudent for the Airport to continue to routinely communicate with FAA tower employees on technology shortfalls such as equipment outages, access to qualified repairmen and the ability to get replacement parts for aging equipment. It is not recommended to investigate new sites for the control tower, as there are not sufficient location-related issues with the current tower. The only line of site issue identified was an apron blind spot that is in an uncontrolled portion of the airfield. This is not considered a significant problem to the FAA and will not be addressed further by this Master Plan. All supplementary development, including vehicle parking, has been determined to be sufficient for the 20-year period.

3.12 SUMMARY OF RECOMMENDATIONS

Planning and investment made to improve infrastructure facilities at the Airport will allow it to meet the air transportation demands of the region for the next 20 years. This chapter has a review of existing infrastructure at the Airport and its ability to accommodate anticipated demand has identified a few areas that should be the focus of future facility planning and development. The following chapter will evaluate development alternatives for meeting the facility identified in this chapter. **Table 3-40** summarizes the recommended improvements from this chapter to the various infrastructure and facilities at Bismarck Airport.

Table 3-40. Future Airport Development	
Airport Facility	**Recommended Improvement**
Runway System	Change Runway 13/31 Design Code from D-IV to D-III
	Change Runway 3/21 Design Code from C-II to C-II
Taxiway System	Add fillets to all taxiways as per latest AC
Approach Lighting	Update Runway 13 to MALS-R or MALS-F
	Add MALS-F to Runway 3
Pavement Lighting	Upgrade to LED lights as projects allow
ILS	Upgrade Runway 31 ILS to address signal reflectivity
Terminal Building	128,000 sf expansion by 2035
Terminal Apron	Expansion to accommodate two additional aircraft
Terminal Gates	Add another 3 gates by 2035
Terminal Parking	Expanded long-term, short-term, and economy areas
Other Parking	Additional employee, rental ready/return, and rental storage needed
Box Hangars	109,300 sf deficit by the end of the planning period
T-Hangars	32-aircraft deficit by the end of the planning period
SRE Facility	Immediate need for additional storage space

MASTER PLAN
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4 Alternatives Evaluation

4.0 ALTERNATIVES ANALYSIS

This chapter presents a range of airside, landside, and terminal alternatives developed to meet the recommended facility requirements documented in Chapter Three. Each alternative considers the short (5-year), medium (10-year), and long-term (20-year) needs of the Bismarck Airport (BIS). Alternatives were developed using four evaluation criteria including economic, operational, environmental and implementation factors. These criteria are discussed below in Section 4.2. The development of alternatives focuses on several key facilities at BIS including the airfield (runways and taxiways), terminal building, vehicular parking, support facilities (operations and maintenance), fuel farm, and general aviation. This chapter presents each alternative and compares the advantages and disadvantages of each to identify a preferred development option for each facility need. It should be noted that some of the recommended alternatives were selected based on a single, logical development action which met the facility needs identified in Chapter Three and accomplished the long-term goals of the Airport. The alternatives presented in this chapter are conceptual in nature and are subject to further refinement through financial, environmental, and engineering means. This chapter presents each of the alternatives considered for future implementation and is organized by the following sections:

- Evaluation Criteria Methodology
- Runways
- Taxiways and Taxilanes
- Airside Facilities Summary
- SRE Facility
- ARFF Facility
- Fuel Farm Area
- Terminal Area
- Air Traffic Control Tower

- Vehicle Parking
- Landside Alternatives Summary

4.1 EVALUATION CRITERIA METHODOLOGY

To evaluate the alternatives, a set of criteria was developed to compare the advantages and disadvantages of each development option. These criteria focused on quantitative and qualitative factors to be considered when weighing the merits and deficiencies of the alternatives under consideration. The evaluation criteria include:

- **Operational Factors** – Each alternative was evaluated for its ability to accommodate the projected level of demand during the 20-year planning period and included, aircraft operations, passenger enplanements, landside vehicle traffic, based aircraft, air cargo activity, aircraft fuel sales, and the demand for hangar and apron space. Other operational factors such as aircraft delay, airfield circulation, and convenience to Airport users were also considered during the comparison of advantages and disadvantages of each development option.
- **Economic Factors** – Qualitative economic factors such as construction and operational costs were considered in evaluating the cost effectiveness of each alternative. This includes costs for design, construction, day-to-day operation, and maintenance. It is important to note that the focus of this evaluation was not to determine the cost to construct each alternative, but rather the type of costs that should be considered when comparing development options.
- **Environmental Factors** – Environmental conditions that could be directly impacted by the proposed development such as noise, air quality, water quality, scenic oversight, land use, and socioeconomic impacts were the focus of this criterion. It should be noted that significant environmental considerations as they pertain to each alternative were reviewed as a part of this evaluation. A more in-depth overview of the environmental factors that may impact development at Airport is presented in the Environmental Overview chapter.
- **Implementation Feasibility** – This criterion focused on the tangible and intangible factors that should be considered to implement each alternative. Factors such as State Priority System, operational performance, best planning tenants,

environmental and fiscal factors, and probability of unknown contingencies were qualitatively evaluated for each alternative to help support or negate the feasibility of implementing the proposed action.

Each section of this chapter addresses a need that was identified through the review of facility requirements and is organized so that the evaluation of each alternative considers the previously described evaluation criteria. Where multiple alternatives are presented, each section of Chapter identifies a recommended alternative along with justification on why it is the preferred development option for the Airport throughout the 20-year planning period.

4.2 RUNWAYS

Chapter three provided a summary of needs for the runways at BIS including the dimensions, associated NAVAIDS and other design standards. Alternatives will be provided below that address each of these issues. Supporting facilities to the runways, such as instrument approaches and runway protection zones, will be addressed in subsequent sections. In general, the runways are meeting current and anticipated needs although minor changes are needed to comply with current FAA standards.

4.2.1 Runway 13/31

As noted in Chapter Three, Runway 13/31, does not meet current FAA grading standards within the first and last quarter of the runway. The Airport was recently awarded a FAA Airport Improvement Plan (AIP) Grant for the reconstruction of Runway 13/31. This reconstruction project began in July 2017 and will continue during normal construction seasons until completion in October 2019. This project will correct the grading issues noted above as well as increase the PCN value from the current 46 to approximately 89. As identified in Chapter Three, the critical aircraft selected for Runway 13/31 is the MD-83. As a result, the future Runway Design Code (RDC) for Runway 13/31 is D-III.

However, because some aircraft larger than MD-83 are anticipated to use Runway 13/31 over the next 20-years, some changes to the supporting surfaces of Runway 13/31 were considered. For example, current FAA design standards for runways having an RDC greater than D-III recommend that runway shoulders be paved to a width of 25 feet to support the potential for large aircraft to deviate from the runway; however, based upon the Engineering Design Report (EDR) the runway shoulders for Runway 13/31 will not be paved as part of the runway rehabilitation project currently underway. This is due primarily to the typical size of aircraft operating from BIS as well as the cost of implementation. In addition, FAA design standards recommend paved blast pads at the end of each runway. FAA concurred with this recommendation and has included paved blast pads measuring 200 feet wide by 200 feet in length at the end of Runway 13 and 31 as part of the runway reconstruction project. As of October 2017, a paved blast pad has been completed for Runway 31 end. The dimensions of the runway are otherwise found to be adequate to serve the anticipated aircraft over the 20-year planning period. The runway has also been assessed and found that a MALS may be adequate in the future.

4.2.2 Runway 3/21

As stated in Chapter Three, the future RDC for Runway 3/21 is C-II. The crosswind runway currently meets the needs of most existing users. As a result, no major geometric changes are considered necessary over the planning period. Currently, the existing Runway Design Code (RDC) for Runway 3/21 is designated as C-II-4000. The RDC (C-II-4000) is composed of three components. Each component represents specific FAA design standards that apply to Runway 3/21. For example, the first component (C) in C-II-4000 refers to aircraft approach speed. The second component, (II), in C-II-4000 represents the aircraft wingspan or tail height of the largest aircraft expected to operate on the runway, whichever is more restrictive. The third component, (4000), in C-II-4000 is based on the runway's lowest visibility minimums expressed in feet for Runway Visual Range (RVR). Another common way FAA expresses this distance is through the

conversion of feet into statute miles. Using this conversion, 4000 feet is approximately ¾- statue miles. For Runway 3/21, the lowest visibility minimum available is associated with the Localizer Performance with Vertical guidance (LPV) instrument approach to Runway 3. Finally, the use of 4000 feet to represent visibility distance should not be correlated with actual runway length. Runway 3/21 is 6,600 feet in length.

Based on aircraft manufacturer sales projections, commercial airlines are expected to retire and/or reduce use of regional jet aircraft such as the 50-seat regional jets including the CRJ-200 over the next decade and replace them with larger 70- to 90-seat regional jet aircraft. As shown in Table 1, many of the 70- to 90- seat regional aircraft anticipated to replace the existing 50-seat regional jets that serve BIS are classified as RDC category C-III. While many of these C-III aircraft are expected to operate from BIS over the next 20-years, the aviation forecasts developed for the 2018 Bismarck Airport Master Plan indicate that C-III aircraft operations will not reach the FAA threshold for reclassification of 500 annual operations on this runway by the end of the planning period (2035). As a result, it is recommended that the RDC for Runway 3/21 remain C-II-4000 for length and width, but the activity of these larger aircraft does warrant consideration to increase the PCN of the runway to accommodate the operations now, without experiencing premature pavement deterioration.

Runways serving C-III aircraft with a maximum takeoff weight over 150,000 pounds are recommended to have a blast pad measuring 200 feet wide and 200 feet long. As some variants of the Airbus A319 meet this requirement and will occasionally use this runway, it is recommended that blast pads be expanded to meet this standard. The fillets and 60' width of the accompanying taxiways is to remain at a larger TDG to allow these aircraft to safely operate when necessary.

The Bismarck Airport is also in need of additional wetland mitigation on airport property. The Central Watershed Area drains from behind the Air Traffic Control Tower, across the airfield, and eventually into Apple Creek. The previously completed 2010 Drainage Study identified this area as requiring substantial work to facilitate the drainage improvements required to help prolong the pavement life of both Runway 13-31 and Runway 3-21. It is recommended that a pavement rehabilitation and drainage project be scheduled to address these concerns. This will be discussed further in Chapter 5.

4.3 INSTRUMENT APPROACHES

Instrument approaches allow aircraft to land at an airport when weather would otherwise be prohibitive. Providing optimal instrument approaches allows airports to continue operations with minimal interruptions. As stated in Chapter Three, Runway 3 has the highest level of wind coverage for instrument flight rules (IFR) conditions of any single runway end, as shown below in Table 4-1. Currently, Runway 3 offers a single RNAV approach with 200-foot ceiling and 3/4 miles visibility limitations.

Table 4-1: BIS IFR Crosswind Coverage

Crosswind Component	Rwy 13	Rwy 13/31	Rwy 31	Rwy 3	Rwy 3/21	Rwy 21	All Runways
10.5 knots	61.36%	**89.04%**	61.57%	70.53%	**79.50%**	47.67%	**96.57%**
13 knots	64.18%	**93.92%**	64.51%	76.36%	**86.46%**	50.16%	**98.93%**
16 knots	66.83%	**97.91%**	66.91%	82.06%	**93.22%**	52.80%	**99.84%**
20 knots	67.90%	**99.50%**	67.93%	85.87%	**97.47%**	53.96%	**99.97%**

Source: FAA AGIS wind analysis tool

Utilizing this crosswind coverage by decreasing visibility limitations to 1/2 mile would require the installation of one of the approach lighting system (ALS) shown below.

- Medium Intensity ALS with Sequenced Flashers (MALSF)

- Medium Intensity ALS with Runway Alignment (MALSR)
- Simplified Short Approach Light System with Runway Alignment (SSALR)
- ALS with Sequenced Flashing Lights (ALSF)

An ALSF is used for more restrictive CAT-II and CAT-III approaches not present at BIS. Both the MALSRs and SSALRs have identical layouts with sequenced flashing lights, the difference being that SSALRs use high intensity lights. For this reason, MALSFs are a more economical ALS and approved for CAT-I approaches. It is recommended that if another approach is added to the Runway 3 end then a MALSF be used as the ALS for the approach.

4.4 NAVIGATIONAL AIDS

Navigational Aids (NAVAIDs) provide pilots increased situational awareness and aid them in finding and maneuvering the airport environment. The previous chapter conducted a review of Airport NAVAIDs and determined that only minor modifications are recommended beyond the existing plans. Existing projects include separating the MALSR control building further west and to make improvements to the existing grade for a new FAA-owned MALSR lighting system to be installed during the runway rehabilitation project currently underway. This improvement is intended to eliminate signal reflection issues affecting some aircraft types. Assess roads to the airside NAVAIDs will also be relocated to no longer conflict with safety areas.

The remaining NAVAIDs at BIS are currently meeting Airport needs and expected to continue to do so for the duration of the 20-year planning period. These NAVAIDs include the Automated Surface Observing System (ASOS), airport beacon, PAPIs, and segmented circle and wind indicators while minor changes are anticipated for other equipment. This includes updating the runway and taxiway lighting to light emitting diode

(LED) lighting, which is more efficient, and updating signage to achieve compliance with FAA AC 150/5340-18F, Standards for Airport Sign Systems.

4.5 RPZ COMPLIANCE

RPZs at the Airport are sized appropriately for the existing approaches. As discussed in Chapter Three, the Runway 31 RPZ extends over Yegan Road. The alternatives identified in this Master Plan do not trigger the need for an RPZ study to be completed. The area located south of the Runway 3 threshold which includes Airport Expressway, Airway Avenue, and the existing RPZ falls within an uninhabited area. Should the Airport ever implement lower approach visibility minimums for Runway 3, then the existing RPZ would be expanded beyond these two roadways and result in a conflicting land use for RPZs. Airport Expressway is a four-lane highway with businesses located to the south. Relocating the highway out of the RPZ would be very difficult due to its size and surrounding businesses. Although lowered visibility requirements would increase the utility of Runway 3, this is not likely to be a need within the 20-year planning period and would have negative impacts to the surrounding community. Therefore, decreasing the runway visibility minimums is not recommended at this time.

4.6 TAXIWAYS AND TAXILANES

This section will provide a review of the findings from Chapter Three and present the taxiway alternatives considered to meet future needs.

4.6.1 Taxiway Alternative 1: Reconstruction to Standards

Taxiway Alternative 1 includes a complete reconstruction of the taxiway system to comply with current FAA 150/5300-13A design standards. FAA standards for taxiway dimensions and runway separations are often updated as the aircraft fleet evolves over time. The most recent FAA standards are applied to the airside environment as shown in **Exhibit 4-1.** The separation of runways and parallel taxiways are based on the performance and

dimensions of the aircraft intended to use them. Each runway would require a parallel taxiway separation of 400 feet and taxiway fillets would need to be added to most turns. Due to the length of aircraft, the nose gear of the aircraft will often travel a different asymmetrical path than the main gear. Fillets help provide additional pavement to compensate for this turning pattern.

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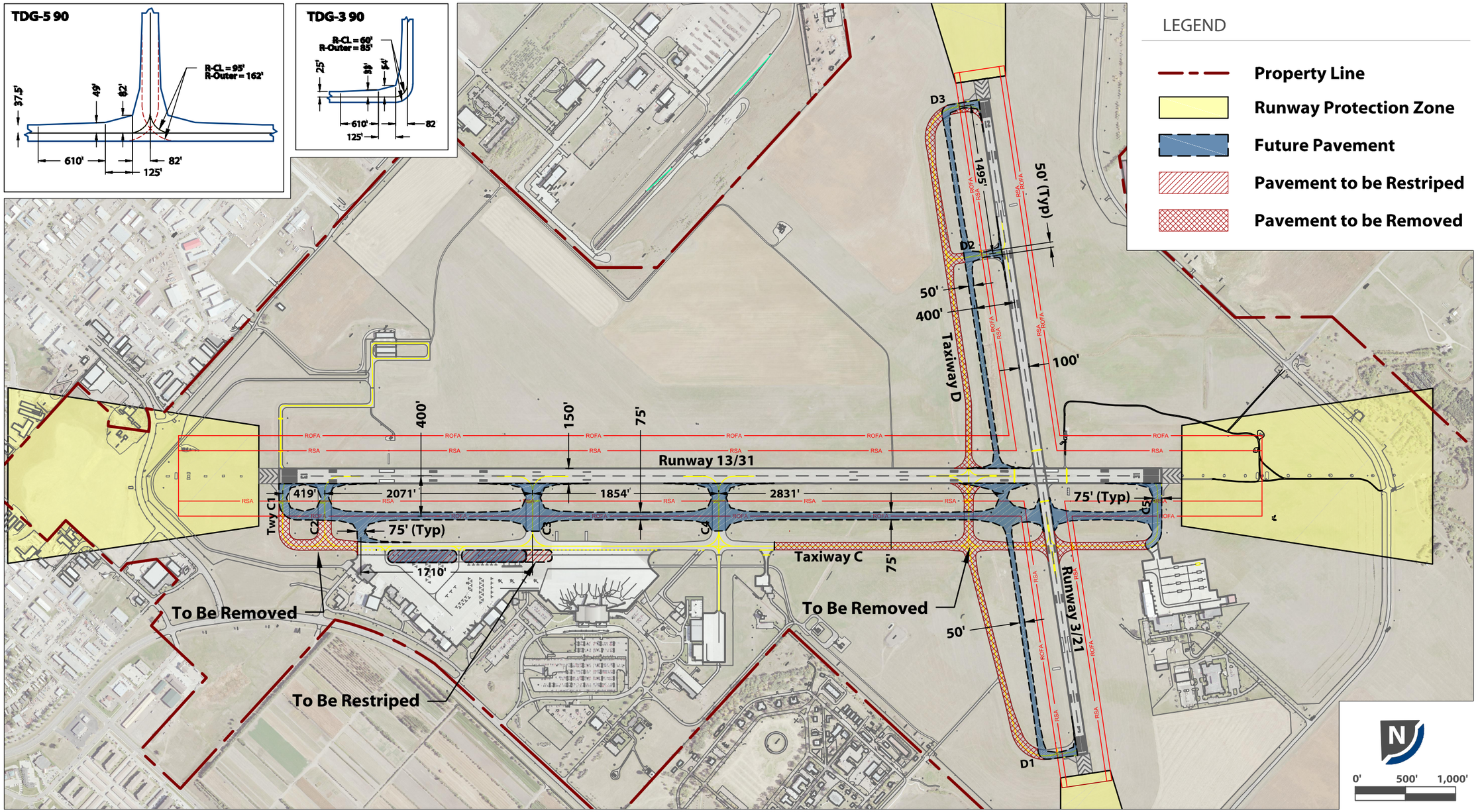

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Exhibit 4-1 **Taxiway Alternative 1: Reconstruction**

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4.6.2 Taxiway Alternative 2: Priority Modification

Taxiway Alternative 2 represents the taxiway modifications needed to meet the Airport's highest priorities for compliance with current FAA taxiway design standards as per AC 5300-13A. It is important to note that these recommended improvements are consistent with those approved by FAA as part of the current runway rehabilitation project underway at the Airport. Taxiway C and connectors C1, C3, C5 and Taxiway D between Runway 13/31 and Taxiway C are intended to serve large aircraft, such as the Boeing 747 and Boeing C-17, and so are approved for TDG V standards. The primary change to the taxiway environment will be the addition of fillets and narrowing connector C4. The new taxiway fillet design will meet current FAA design standards while still providing aircraft with adequate corners to enter and exit Runway 13-31. Taxiway layouts are shown on **Exhibit 4-2**.

In addition to modifying the width and fillets associated with Taxiways C3 and C4, both C3 and C4 provide direct access from an aircraft apron to the Runway 13-31. Direct apron to runway access is discouraged by FAA because taxiways leading directly from an apron to a runway without a turn increase the potential for a runway incursion. Taxiway C3's direct apron to runway connection can been mitigated by restriping the existing non-aircraft movement area island located between the air carrier apron and the entrance to Taxiway C3. These markings would effectively extend the non-aircraft movement island to the southeast along Taxiway C to prevent pilots from taxiing aircraft directly across this segment of the air carrier apron to the runway. Restriping the existing pavement markings would be a less expensive alternative than removing the pavement in this area. Taxiway C4 connects with Taxiway E near the midpoint of parallel Taxiway C and provides direct access to the corporate apron. Despite having a 600-foot separation from the entrance to Taxiway C4 to the corporate apron, FAA considers this to be a direct connection to

Runway 13-31 because pilots are not required to make a right or left-hand turn before reaching the runway environment.

There are additional taxiways that do not meet current FAA ADG III taxiway design standards; however, it is not uncommon for many airports to have taxiway separations which exceed current design standards. FAA recognizes these taxiways exceed the current standard for width and have approved them to remain in place under the current runway rehabilitation project. It is important to note that Taxiways C1, C3, C5, Taxiway C and Taxiway D (between Runway 13-31 and Taxiway C) have been approved by FAA to be built for ADG V standards to accommodate the use of large aircraft (i.e. B747 and C17). In addition, Taxiways C2 and C4 will be constructed to ADG IV standards. During the reconstruction or rehabilitation of taxiways in the future, all hold lines will be updated to reflect current FAA guidance on reference to runway elevation.

FAA's decision to maintain these nonstandard taxiway widths is based on their ability to safely accommodate future aircraft operations throughout the 20-year period. In addition, FAA acknowledges the cost to reconstruct these taxiways, and the accompanying lights, signs, and markings, would require considerable expense without any benefit of improving safety. Based on coordination and approval with FAA, these taxiways, along with D1, D2, and D3, will remain unchanged and have not been included in Taxiway Alternative 2.

In conclusion, Taxiway Alternative 2 is the recommended taxiway alternative and will be carried forward into the preferred alternative incorporated into the airport layout plan. Taxiway Alternative 2's primary purpose is to reflect those taxiway improvements which improve safety in a financial responsible manner as approved by FAA under the current runway rehabilitation project.

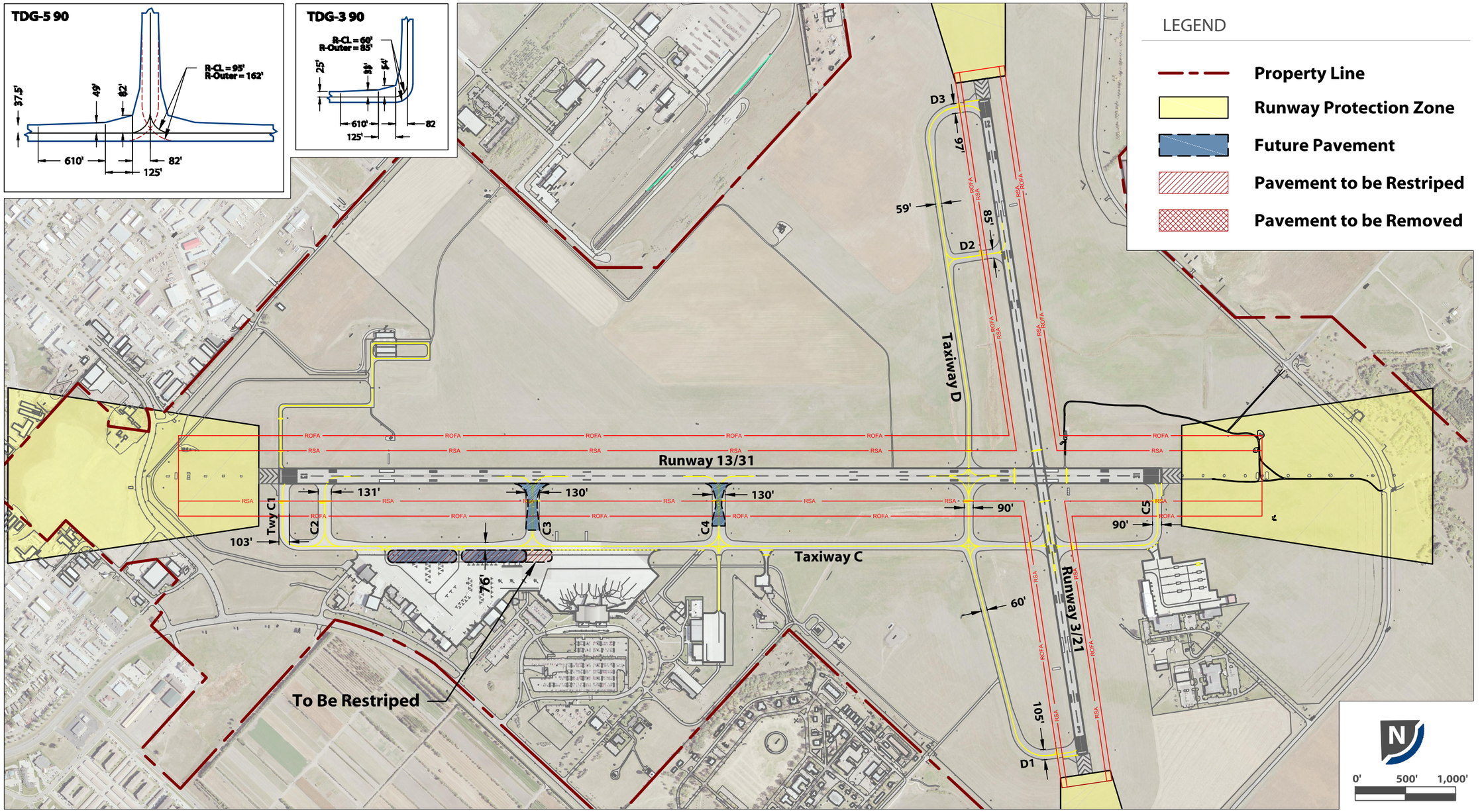

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Exhibit 4-2 **Taxiway Alternative 2: Priority Modification**

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4.7 AIRSIDE FACILITIES SUMMARY

The alternatives discussed in this section, including existing RPZs and NAVAIDS are collectively shown in **Exhibit 4-3** and **Exhibit 4-4** to demonstrate their relationship to each other when constructed.

4.7.1 Snow Removal Equipment (SRE) Facility

The SRE building is undersized to serve the number and type of existing vehicles. The existing conditions of the SRE facility and a list of housed equipment are found in Chapter 1 of this document. SRE vehicles are becoming increasingly larger resulting in the inability of the existing SRE to meet future demands. This section below identifies two SRE alternatives developed to sufficiently store equipment and provide areas for maintenance needed in the short-term (5-10 years). Long-term, a new SRE facility consisting of 28,000 SF of building space and 80,000 SF of supporting pavement is recommended to meet the future needs throughout the 20-year planning period. SRE Alternatives 1 and 2, described below, reflect two options designed to meet short-term facility needs; however, both alternatives also include a long-term option capable of meeting future demand through year 2035.

SRE Alternative 1: South Expansion

SRE Alternative 1 expands the SRE building and apron to the south, as shown in **Exhibit 4-5**. This alternative maintains the existing width of the SRE building while extending its length further south along its current axis. Currently, SRE vehicles must back directly into the facility while avoiding equipment located on each side of the pull in bay. SRE Alternative 1 provides an additional 9,000 SF of vehicle storage space and includes an additional 10,700 SF of pavement to support SRE activities in front of the building. SRE Alternative 1 meets the near-term goal of increasing storage space but does not address the long-term equipment circulation issues anticipated during the last ten years of the

planning period (2025-2035). Long-term needs would be met by construction of a new SRE facility to the northeast.

SRE Alternative 2: West Expansion

As shown in **Exhibit 4-6**, SRE Alternative 2 extends the overall width of the existing SRE facility by adding an additional 12,000 SF of building space to the west and extending the accompanying apron by an additional 64,000 SF further south and west. By reconstructing and extending the west side of the building this would allow a sufficient width to construct pull through bays for vehicles with supporting apron on either side. This would not only increase the storage capacity of the building but improve vehicle circulation. SRE Alternative 2 is the recommend option for meeting the near-term SRE needs because it enables vehicles to pull through both sides of the building and creates additional storage space for equipment. Long-term, a new SRE facility consisting of 28,000 SF of building space and 80,000 SF of supporting pavement will best meet future needs throughout the 20-year planning period. SRE Alternative 2 will be carried forward in the development of the preferred alternative included in the airport layout plan.

4.7.2 Aircraft Rescue and Firefighting (ARFF) Facility

Although many of the ARFF facilities are meeting current demand, such as personnel and storage spaces, the equipment used in ARFF is becoming larger. Lower centers of gravity and wider wheelbases resist vehicle roll-over while cornering and carrying a full load of water and chemical. One of the current ARFF response vehicles is slated to be replaced around the year 2020 and an ARFF facility expansion is recommended to accommodate the current ARFF vehicles and future larger vehicles.

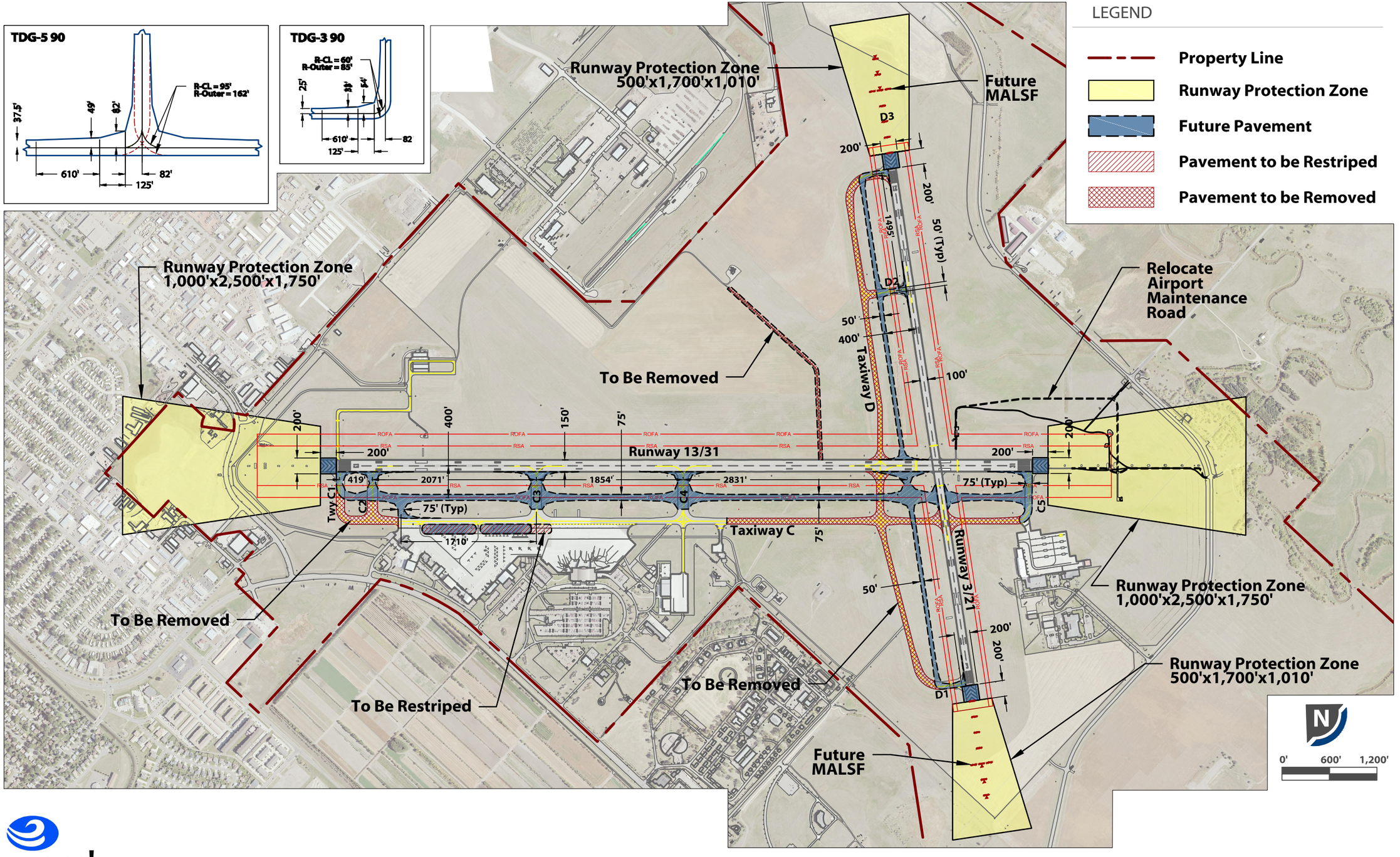

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Exhibit 4-3 **Airside Alternatives Summary 1**

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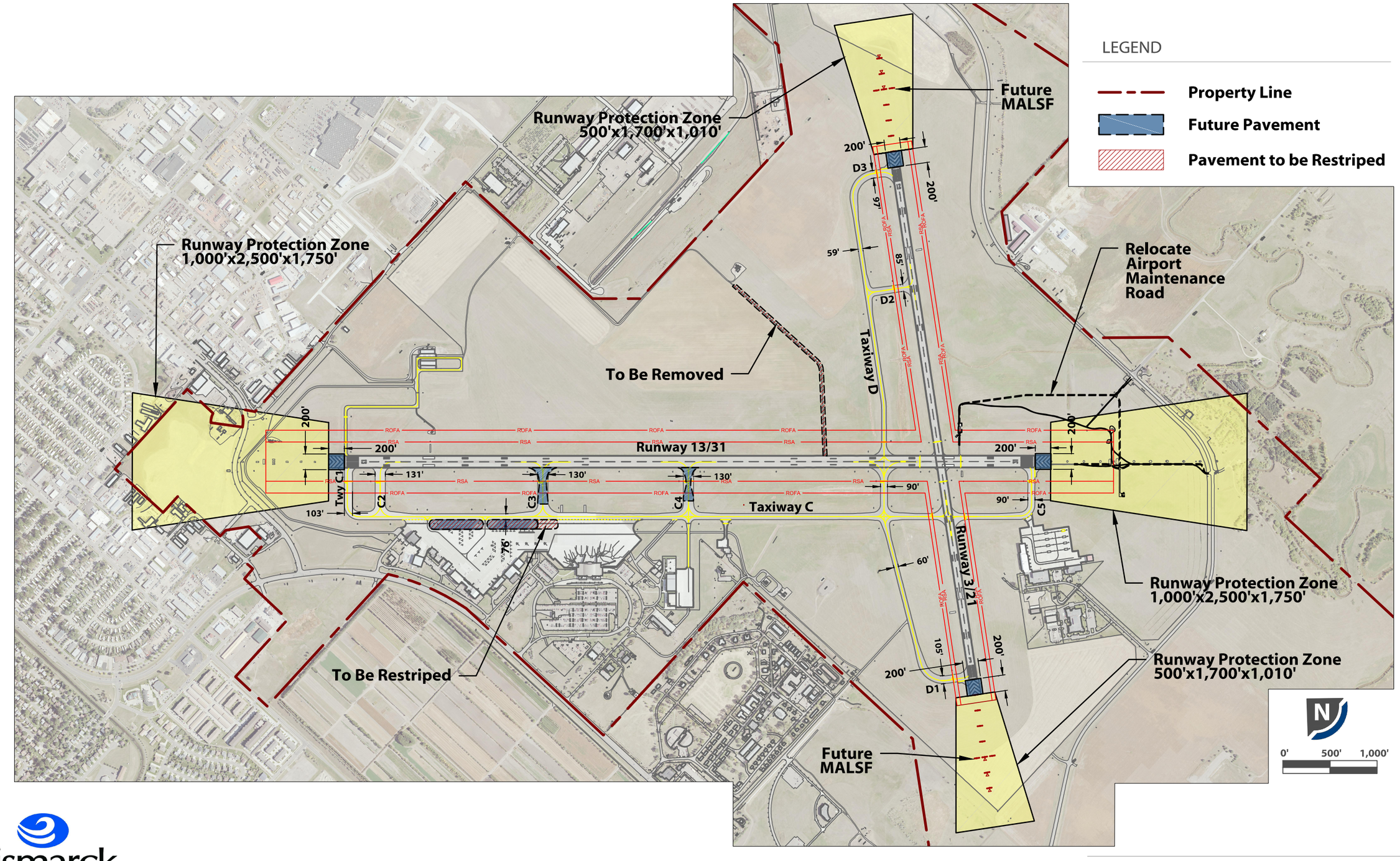

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Exhibit 4-4 **Airside Alternatives Summary 2**

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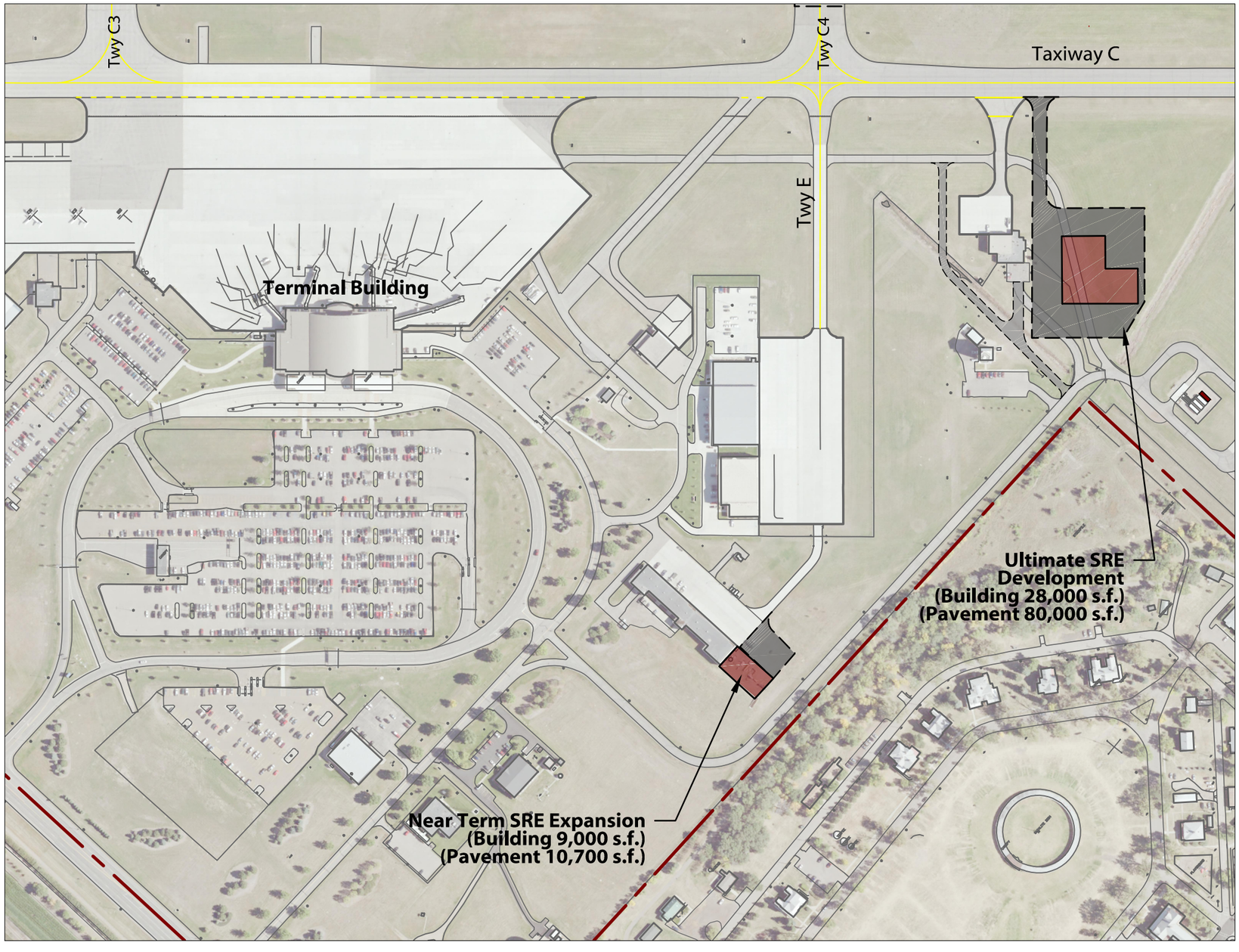

LEGEND

- Property Line
- Future Building
- Future Pavement
- Future Roadway

N

0' 150' 300'

Exhibit 4-5 **SRE Alternative 1: South Expansion**

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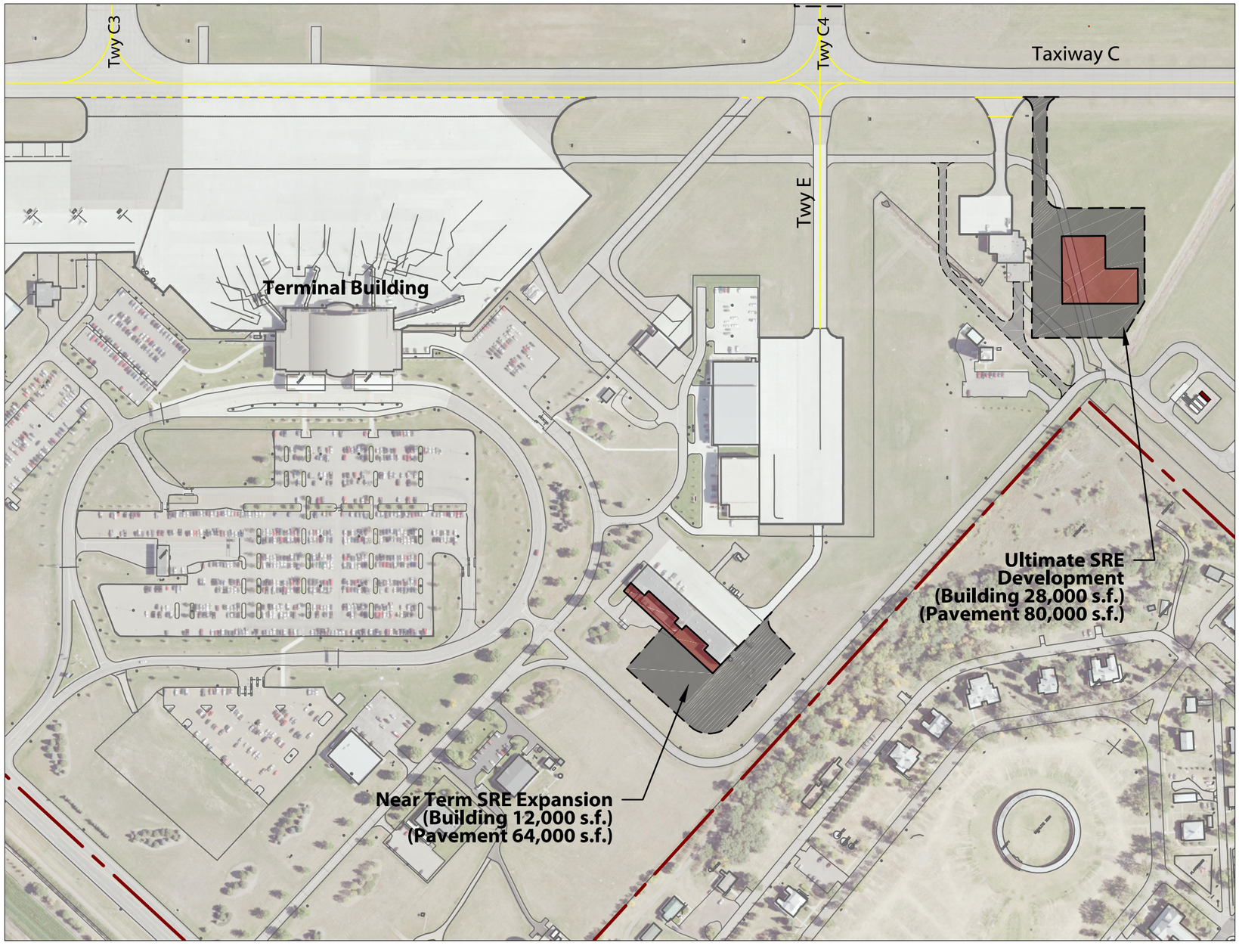

LEGEND

- Property Line
- Future Building
- Future Pavement
- Future Roadway

N

0' 150' 300'

Bismarck AIRPORT Master Plan Update

Exhibit 4-6 **SRE Alternative 2: West Expansion**

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4.7.3 General Aviation Development Areas

General Aviation development at BIS is divided into several sections. This is beneficial as safety and efficiency are often improved by separating operations by aircraft type and providing a safety buffer for turbine and piston aircraft. Each area will be addressed in the following sections to determine local hangar, apron and other supporting facility needs.

Hangars provide a place for aircraft to be sheltered from the elements, such as the harsh North Dakota winters, and allow pilots to perform limited maintenance. Although small aircraft will sometimes utilize tie downs, most pilots prefer hangars. Hangars are necessary for most corporate turbine aircraft based at BIS. Therefore, it is important to have available hangar space for potential tenants. Chapter Three determined that 109,300 square feet of box hangars and 63,000 square feet of T-hangar units will be required by the end of the 20-year planning period. This demand will be satisfied over a series of alternatives for each development area in the following sections. As piston and turbine aircraft are often separated for safety, T-hangars are usually constructed away from corporate areas. Box hangars could be constructed in existing corporate areas and separate areas will be developed for smaller GA aircraft, such as recreational or private pilots. Finally, Chapter Three determined that the Airport has enough apron for the overall needs of the Airport. Therefore, this section will consider apron expansions intended to serve specific functions on the Airport and compliment suggested expansion of hangars and other facilities.

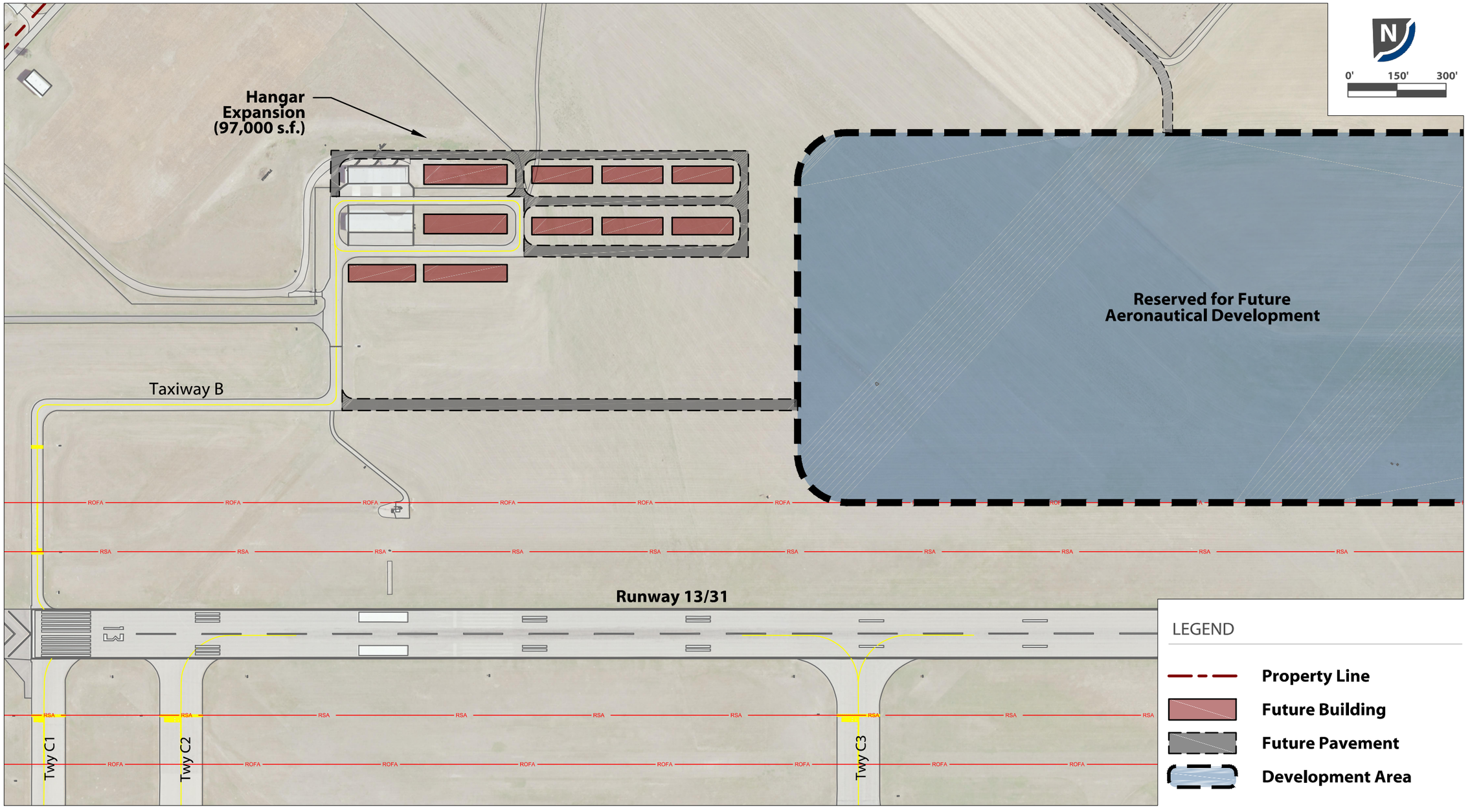
GA Hangar Area

Much of the Airport's piston GA activity is located near Taxiway B. This area is not yet fully developed; therefore, there is potential to construct additional hangars, either T-hangars or joined box hangars, to provide spatially efficient and more economically feasible options for recreational pilots. A proposed buildout of the existing configuration can be seen in **Exhibit 4-7**, with 97,000 square feet of new hangar development. The

large area to the southeast is reserved for future aeronautical development and is anticipated to accommodate increases in demand beyond the 20-year planning period. This area can provide connections to the airfield and nearby roadways. As it is unknown as what specific type of buildings and tenants will eventually be constructed here, it is considered prudent to not plan specific development at this point. As the region grows, additional taxiway connections should be considered based on the type of activity occurring within this area. Currently, Taxiway B provides a single access point to Runway 13/31 and could lead to congestion in this area as traffic increases over time.

North General Aviation Development Area

The GA apron is located to the northwest of the air carrier apron and is constrained due to the number of users concentrated in this area. Although there is a large amount of apron at BIS, reconfiguration or expansion in this area is needed to improve circulation. As mentioned in the previous chapter, there are existing plans to expand the apron 650 feet to the northwest parallel to the primary runway. Hangar 5 is currently located along the GA apron but will be removed to allow for additional expansion of GA ramp. This location would provide convenient access to the Runway 13 threshold for corporate and other aircraft that would utilize the FBO or other GA hangars. This expansion would aid in promoting better circulation and allow additional hangars to be constructed, as seen in **Exhibit 4-8**. Hangars constructed along the GA apron expansion could provide approximately 67,000 square feet of box hangars.


Hangar
Expansion
(97,000 s.f.)
Taxiway B
Reserved for Future
Aeronautical Development
Runway 13/31
Twy C1
Twy C2
Twy C3
ROFA
RSA
N
0'
150'
300'
LEGEND
Property Line
Future Building
Future Pavement
Development Area

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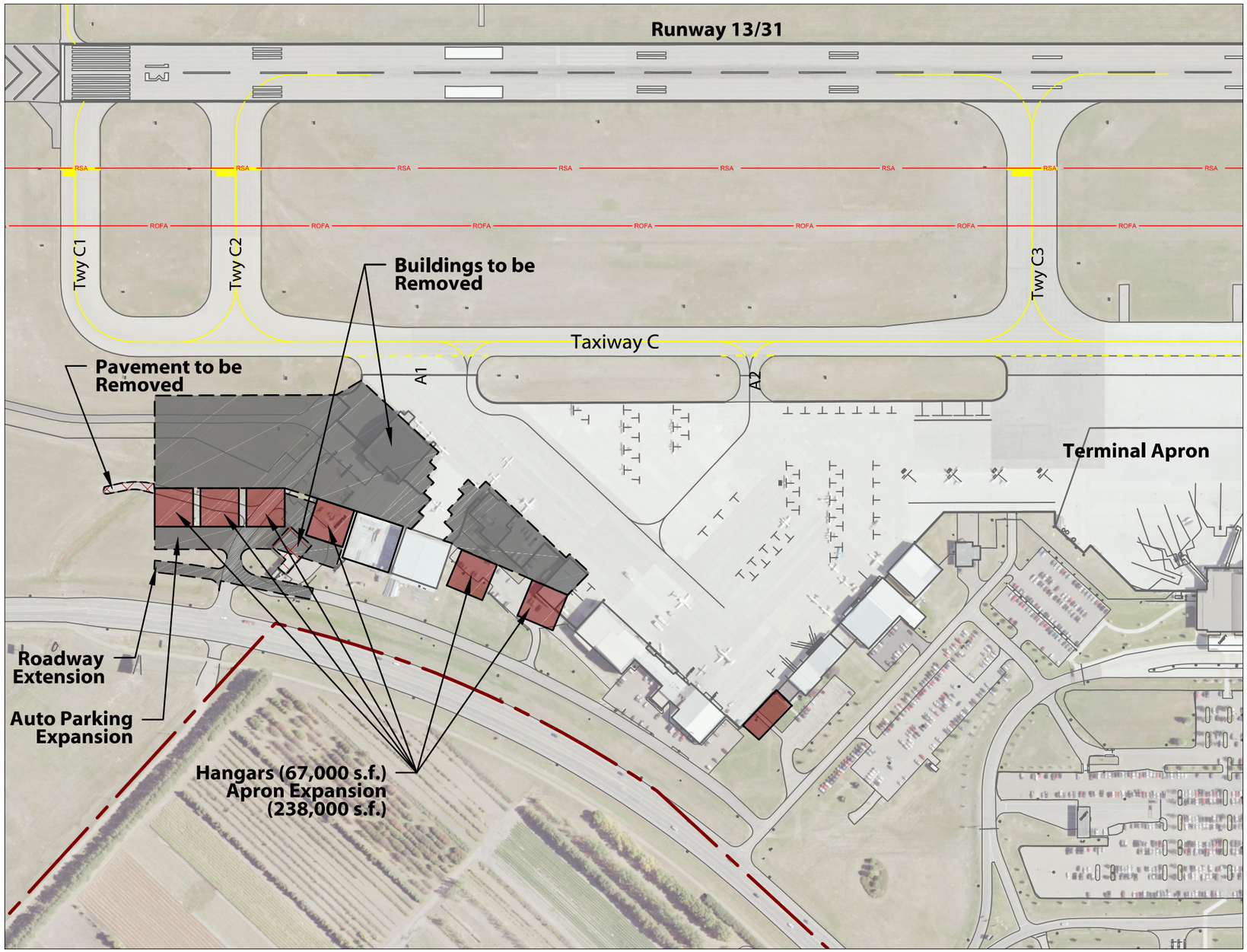

LEGEND

- Property Line
- Future Building
- Future Pavement
- Pavement to be Removed

N

0' 150' 300'

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Exhibit 4-8 **North General Aviation Development**

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South Corporate Development Area

The corporate hangar area located south of the terminal building near the ATCT consists of two hangars with a supporting apron. To meet future corporate aircraft demand, an additional 86,000 SF of box hangars with attached office space and 94,000 SF of new apron are proposed. As shown in **Exhibit 4-9**, the corporate hangar area provides convenient access to the airfield and can accommodate a designated vehicle entrance separate from Terminal Boulevard. The expansion of the corporate hangar area is compatible with existing airport land uses and does not impact nearby facilities.

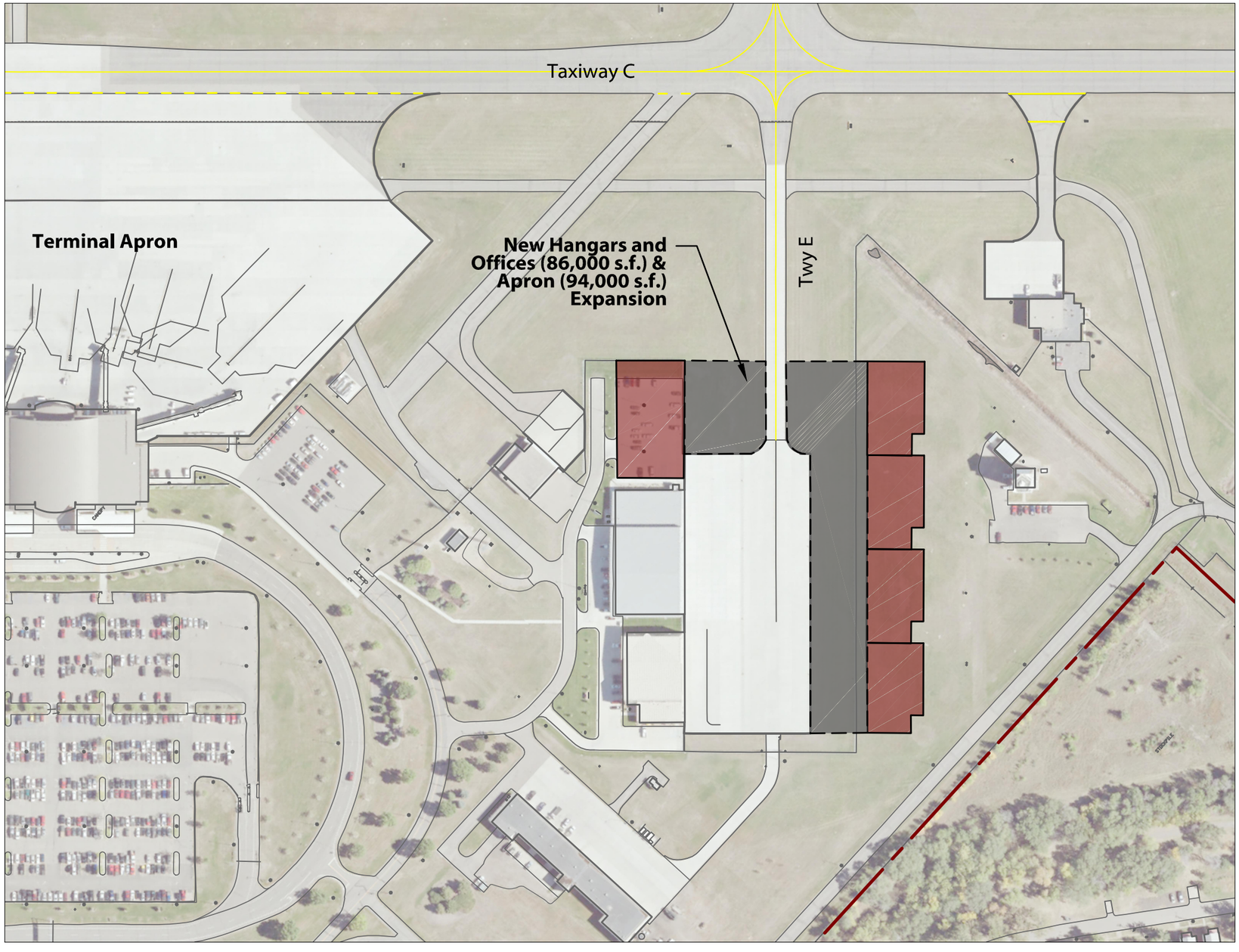
4.7.4 Development Areas Summary

Collectively, these development areas show approximately 97,000 square feet of new T-hangar development and approximately 153,000 square feet of additional box hangar space. While the proposed development areas exceed the 20-year facility requirements identified in Chapter Three, each of these areas are scalable and can be developed as needed. The purpose of these alternatives is to establish a long-term build out plan for those facilities that support aircraft activities while promoting improved circulation and efficiency.

4.8 FUEL FARM AREA

There are two private fuel farms located south of the ATCT. The existing fuel storage capacity at BIS currently meets fuel demand with approximately a seven-day supply of Jet A fuel and an 88-day supply of 100LL fuel. As aircraft activity increases and additional corporate aircraft are based at the Airport the demand for additional fuel storage capacity will increase as well. To meet the anticipated need for additional fuel storage capacity over the 20-year planning period, two additional fuel tanks are recommended. There is adequate space for an additional fuel tank in each fuel farm location. **Exhibit 4-16** depicts the future location for two additional fuel tanks. It should be noted that adequate space

also exists for a third private fuel farm located between the existing two fuel farms or in the area located immediately south.



LEGEND

- Property Line
- Future Building
- Future Pavement

N

0' 100' 200'

Exhibit 4-9 **South Corporate Development**

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4.9 TERMINAL AREA

The present day 78,000 SF terminal at BIS was constructed in 2005 as an entirely new facility. The terminal building has facilitated the Airport's steady growth throughout the last decade. Transitions to larger aircraft, along with added low-cost carriers, have increased enplanements during the same period. As a result, several areas within the terminal are undersized and are resulting in passenger inconveniences. These areas include the TSA Security Check Point, passenger hold rooms, concessions, and restrooms. The Airport has taken steps to increase the size and processing capacity of the TSA Security Check Point; however, the projections of future passenger enplanements necessitate the need for expanding the overall footprint of the terminal building to accommodate demand over the 20-year planning period. As a result, two terminal development alternatives were developed to reflect the additional terminal and concourse space needed. Both terminal alternatives are described below.

4.9.1 Terminal Building Expansion

Terminal Building Expansion Alternative 1: Pier Expansion

As shown in **Exhibit 4-10**, Terminal Expansion Alternative 1 proposes to expand the current terminal building by an additional 10,000 SF to the north and develop a new 50,000 SF pier concourse at the midpoint of the terminal building towards the northeast. Based on the recommend aircraft gate requirements identified in Chapter Three, this alternative increases the number of gates; from the existing four gates to a total of eight gates by 2036. Along with the addition of new gates, retail, security, and hold room areas can also expand to meet future demand and provide improved passenger conveniences.

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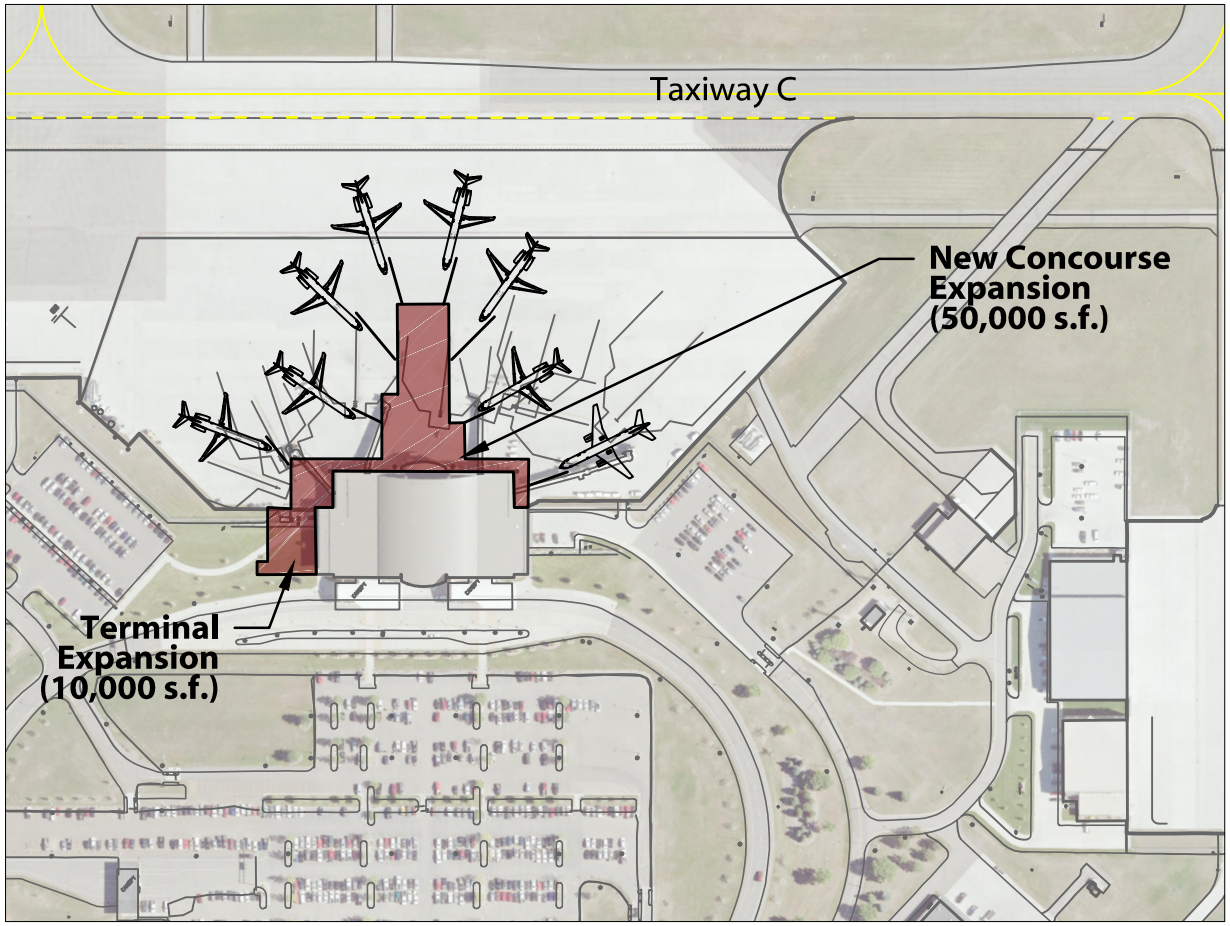

LEGEND

- Property Line
- Future Building
- Future Pavement

0' 150' 300'

N

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Exhibit 4-10 **Airport Terminal Building - Exterior Alternative 1**

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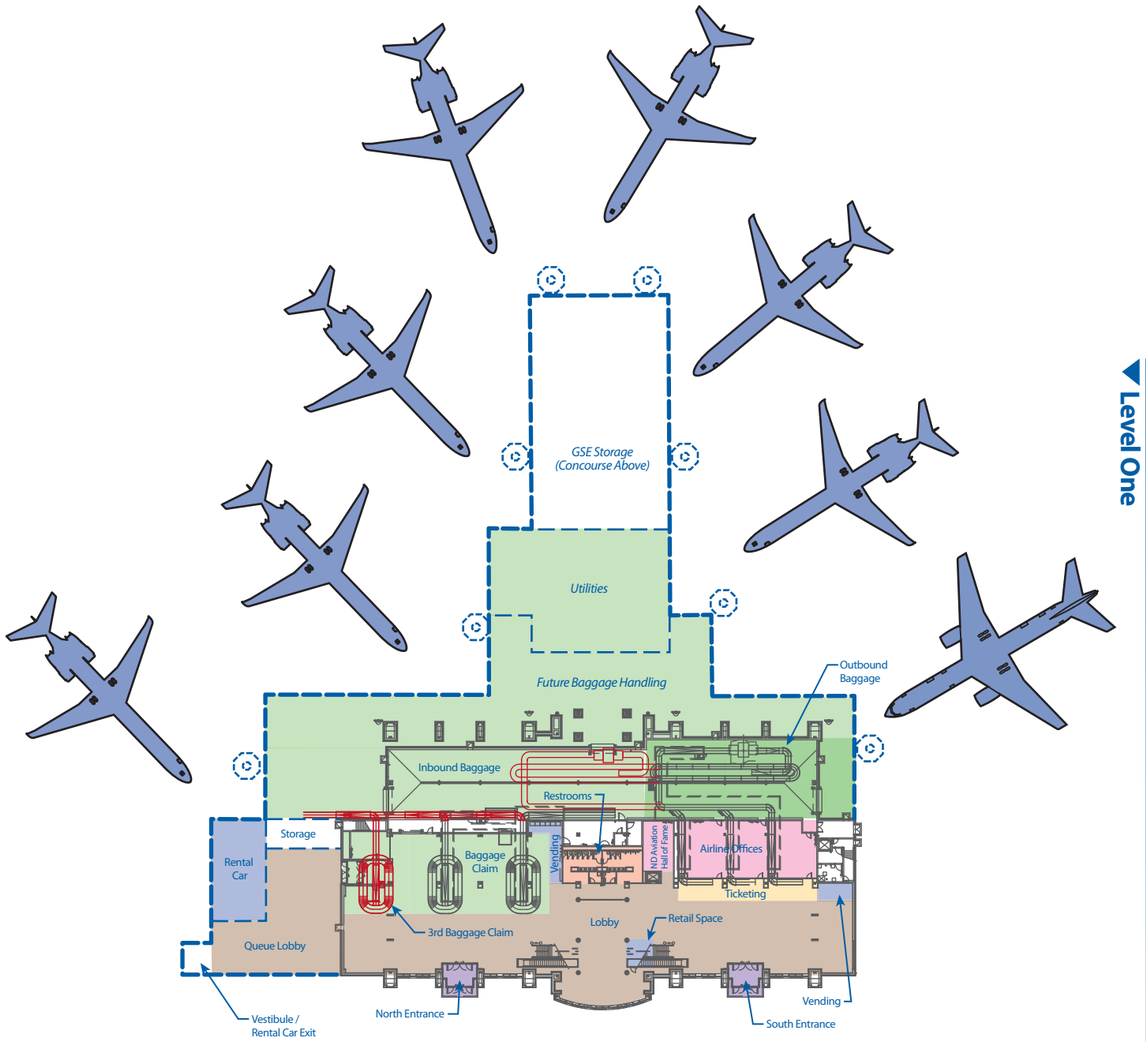
The pier concourse configuration offers the Airport a distinct advantage. As shown in **Exhibit 4-10**, Terminal Alternative 1 a concourse located at the midpoint of the terminal building does not require additional apron area (pavement) to a support future concourse expansion. A mid-pier concourse extension concentrates commercial activity in the same location as present-day operations occur allowing the overall footprint of the terminal area to remain unchanged. In addition, a mid-pier concourse extension can support both large and small air carrier aircraft throughout the 20-year planning period; however, some limitations exist. First, the northward extension of a new concourse would locate aircraft within proximity of the Taxiway Object Free Area (TOFA) located immediately south of Taxiway C. As a result, aircraft located at the end gates would have to contact ATC before taxiing or being moved by a tug into the TOFA, a controlled movement area. For example, aircraft trying to reposition from one side of the terminal to the other would have to first receive clearance from ATC before encroaching into the TOFA. This condition may result in congestion at the end of the concourse during peak activity periods if aircraft need to be repositioned. Second, the development of new pier concourse also creates a significant challenge for snow removal. Much like aircraft having to gain clearance to taxi into the TOFA, snow removal vehicles would also have to get ATC clearance as well. In addition, the development of a pier concourse would alter the way snow is removed from the terminal apron area which could create significant congestion at the end of the concourse during inclement weather. A summary of the advantages and disadvantages for Terminal Alternative 1 are presented in **Table 4-2**.

The pier concourse configuration also provides the opportunity to increase the size of the interior functions within the terminal building and concourse. To meet the anticipated increase in passengers over the 20-year planning period, the size of interior terminal areas including the TSA Security Check Point, hold rooms, concessions, baggage make up and claim, and restrooms must be increased. As shown in **Exhibit 4-11**, Level One and Two within the terminal building include additional space for each of these interior

functions. Level One consists of a third baggage carousel as well as an expanded inbound and outbound baggage make up belt system equipped with an additional TSA baggage screening device needed to meet future demand. The implementation of this additional equipment will help relieve congestion in the queue area and allow bags to be processed more quickly and provide redundancy should one of these systems become inoperable. Level Two of the pier concourse configuration includes new area for a centralized retail space, hold rooms, restrooms, and an enlarged composure area immediately past the TSA Security Check Point. The large expanse of the central portion of the terminal allows for a centralized retail space. This space provides a common area for waiting, eating, and shopping while not interfering with enlarged security checkpoint and composure areas. Airline office and ticketing counter space was not increased due to trends toward self and online check-in and a decrease in checked baggage. A summary of this alternative is provided in **Table 4-2** below.

Table 4-2: Summary of Considerations – Alternative 1

Advantages	Disadvantages
▪ Minimizes passenger walking distances ▪ Improves passenger flow and wayfinding ▪ Consolidated retail and restroom facilities ▪ Enlarged security checkpoint and composure area	▪ Moderate to significant level of impact to existing operations during construction ▪ Majority of expansion needs to be built within 5-year planning period to regain lost gates ▪ Impacts snow removal operations ▪ Proximity of aircraft to TOFA on northeast end of terminal ▪ Pier concourse limited to 8 gates



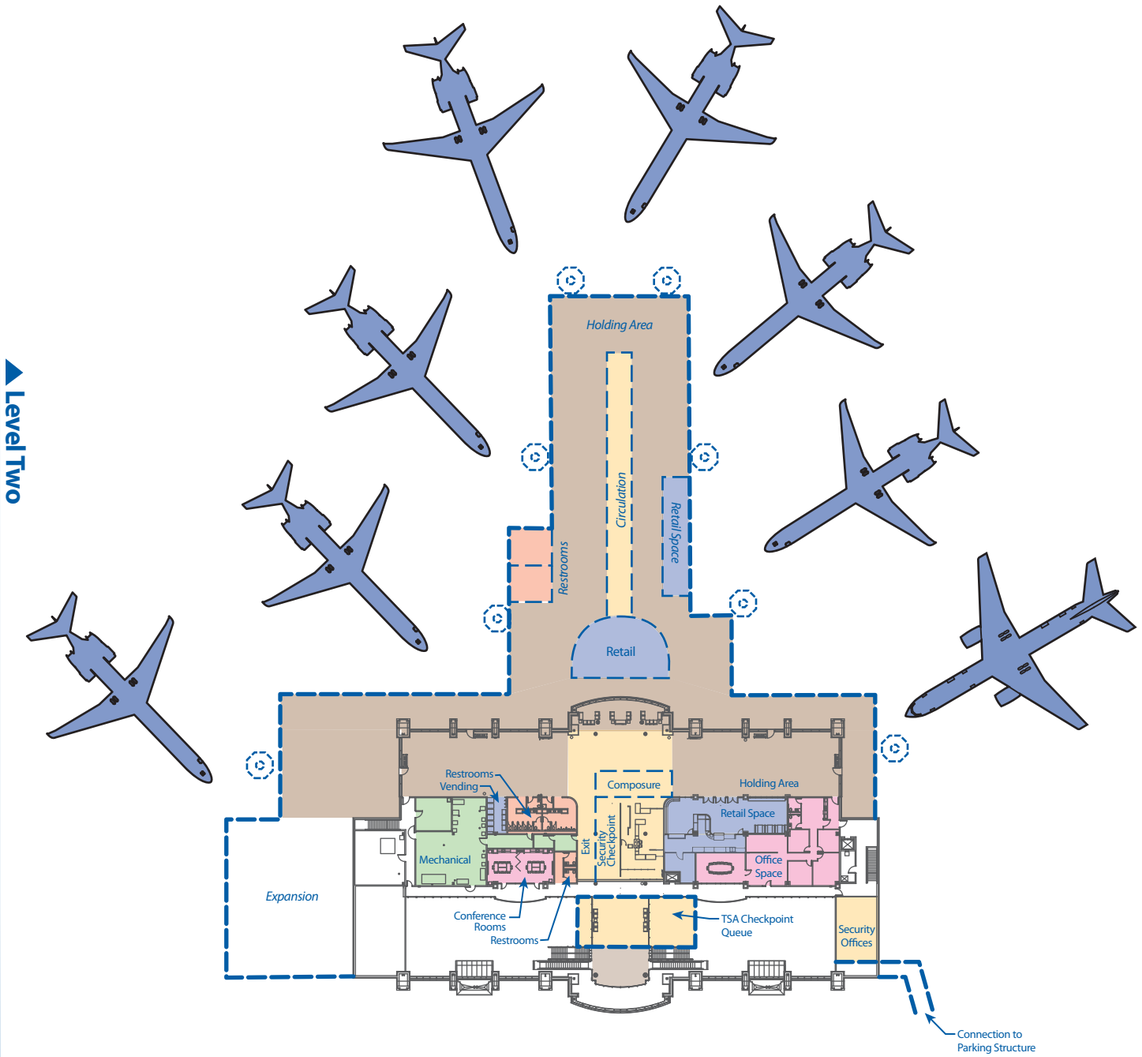


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Exhibit 4-11 **Airport Terminal Building - Interior Alternative 1**

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Terminal Building Expansion Alternative 2: Wing Expansion

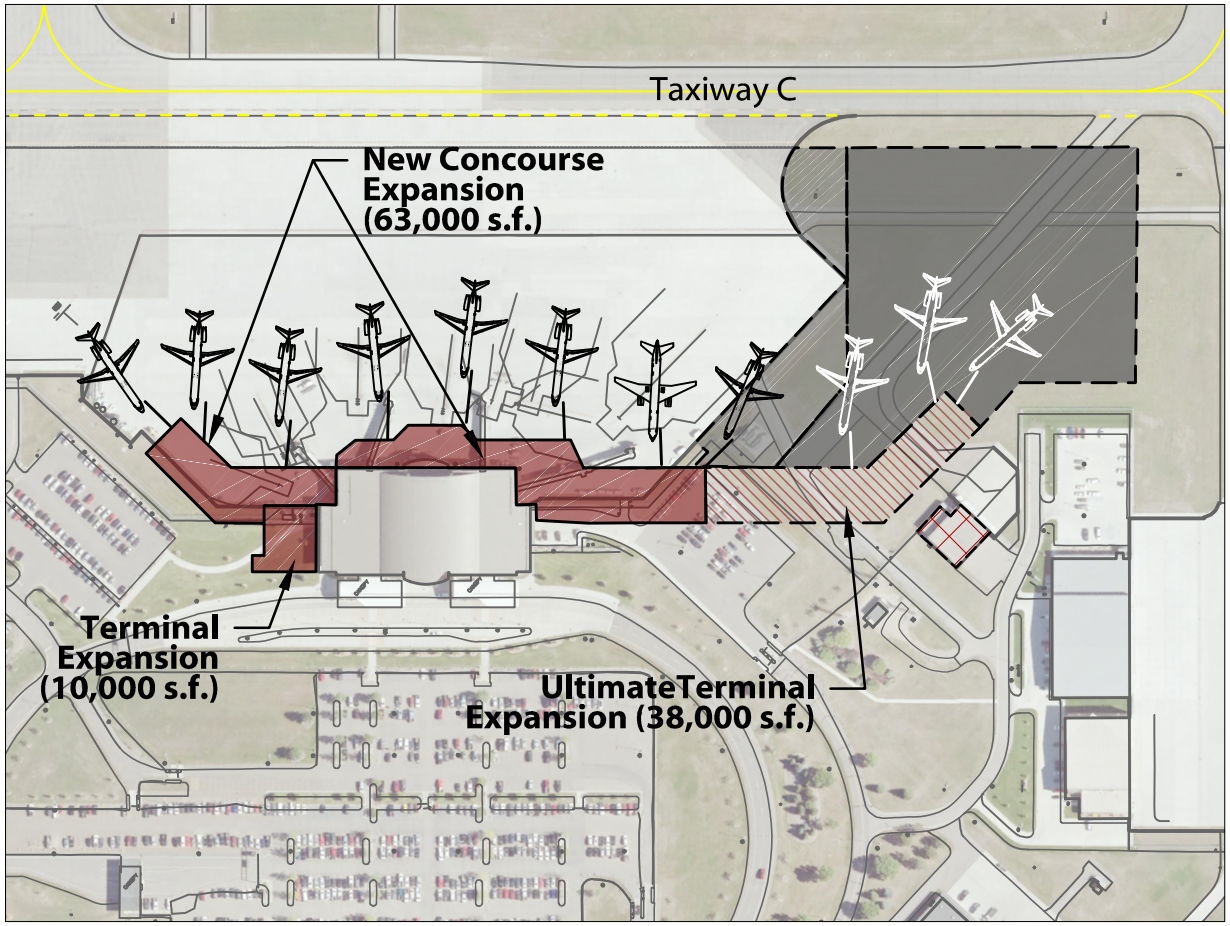
Terminal Expansion Alternative 2 proposes to add an additional 10,000 SF on the northwest side of the existing terminal building and develop a new linear concourse consisting of 63,000 SF oriented in a northwest to southeast configuration. As shown in **Exhibit 4-12**, a linear concourse configuration allows for up to eight gates by 2036. Terminal Expansion Alternative 2 utilizes all the existing terminal apron; however, additional apron is required to provide adequate aircraft parking and circulation at the gate located furthest south. Beyond 2036, the concourse could further be expanded by an additional 38,000 SF to gain three more gates. This would require additional terminal apron immediately south of the existing apron to support these three gates. The primary advantage of Terminal Expansion Alternative 2 is the ability to add additional aircraft gates within and beyond the 20-year planning period without impacting snow removal or creating congestion in an ATC controlled movement area.

The linear concourse configuration also increases the size of the interior functions within the terminal building and concourse. The size of interior terminal areas including the TSA Security Check Point, hold rooms, concessions, baggage make up and claim, and restrooms must be increased to meet future passenger demand. As shown in **Exhibit 4-13**, Level One and Two of the linear configuration include additional space for each of these interior spaces. Level One consists of a third baggage carousel as well as an expanded inbound and outbound baggage make up belt system equipped with an additional TSA baggage screening device. The implementation of this additional equipment will help relieve congestion and allow bags to be processed more quickly and provide redundancy should one of these systems become inoperable. Level Two of the linear concourse configuration includes additional space for a centralized retail, expands the size of hold rooms, new restrooms, and an enlarged composure area immediately past the TSA Security Check Point. The large expanse of the central portion of the terminal allows for a centralized retail space for waiting, eating, and shopping while not

interfering with enlarged security checkpoint and composure areas. Airline office and ticketing counter space was not increased due to trends toward self and online check-in and a decrease in checked baggage. A summary of this alternative is provided in **Table 4-3** below.

Table 4-3: Summary of Considerations – Terminal Expansion Alternative 2

Advantages	Disadvantages
▪ Short aircraft pushbacks ▪ Scalable to meet future demand ▪ Compatible with snow removal process ▪ No impacts to airport geometry ▪ Increases passenger amenities and revenue generating opportunities	▪ Increases passenger walking distance ▪ Increased maintenance and utility costs ▪ Additional pavement (apron) required to support linear configuration



LEGEND

- Property Line
- Future Building
- Ultimate Terminal Expansion (Beyond 20-Year Planning Period)
- Future Pavement
- Building to be Removed

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Exhibit 4-12 **Airport Terminal Building - Exterior Alternative 2**

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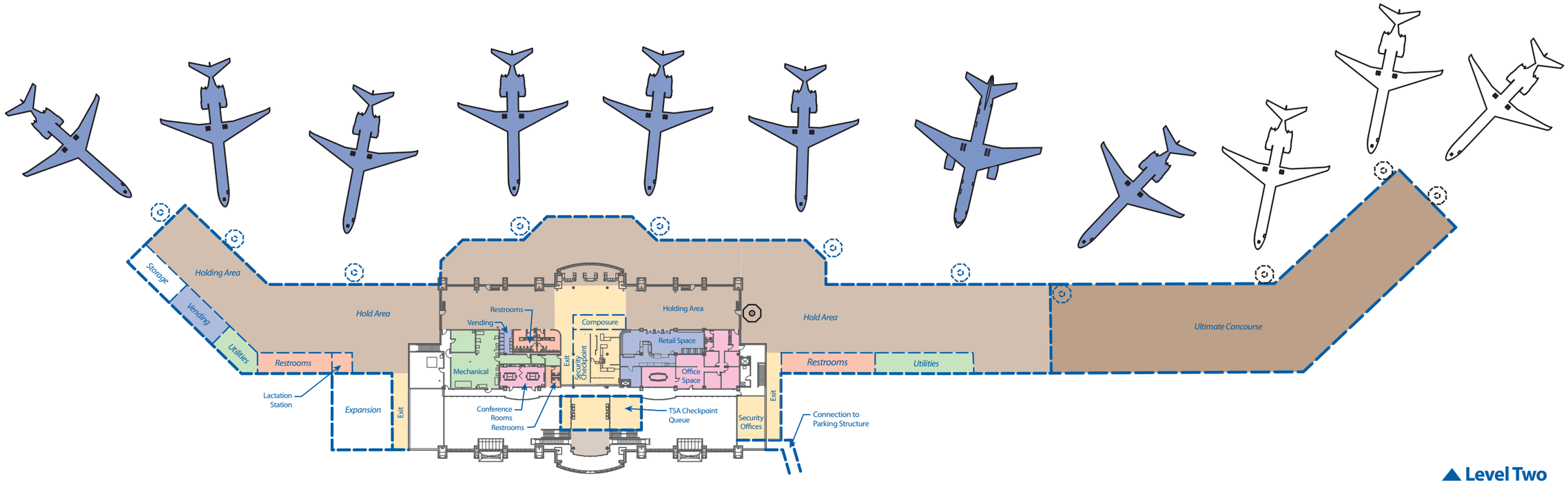

Exhibit 4-13 **Airport Terminal Building - Interior Alternative 2**

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4.10 AIR CARRIER APRON

The air carrier apron supports several functions, such as allowing aircraft and ground support equipment to move to and from the terminal and provides space for aircraft to park overnight. Based on the gate demand conducted in Chapter Three, space for nine aircraft to park and remain overnight will be required by the end of the planning period. The area to the south of the current air carrier apron is largely unoccupied. Expansion in this area would provide additional room for aircraft to park and maneuver as well as support terminal expansion in this direction. The apron would be able to be constructed in phases to grow with Airport needs. The initial phase would provide 46,500 square feet and the second phase would expand the apron to the south towards the existing corporate apron and hangars by an additional 191,000 square feet.

4.11 AIR TRAFFIC CONTROL TOWER/RADAR FACILITY

The ATCT facility is located to the approximately a quarter mile to the southeast of the passenger terminal. This location is free from interference from surrounding buildings or other obstructions. The current location is meeting Airport needs although as expansions occur at the Airport, specifically the passenger terminal building, consideration to ATCT visibility of the Runway 13 threshold will need to be considered during terminal design. The Master Plan recommends continuing to protect the critical design surfaces of the radar facility.

4.12 VEHICLE PARKING

Based on the anticipated passenger and activity growth over the 20-year planning period, 1,085 parking spaces will be needed by the end of the planning period. The expansion of parking areas should be considered so that uses will be complementary with surrounding facilities and provide adequate traffic circulation. Alternatives for increasing Airport parking are discussed below.

4.12.1 Vehicle Parking Alternative 1: Expansion of Existing Parking

This alternative utilizes the green space surrounding the existing parking lots and increases capacity by expanding parking in these areas. The circulation road would be reconfigured to join Jetway Avenue to the south to reduce repetitive roadways and provide additional room for parking in the main lot, as shown in **Exhibit 4-14**. Aside from the roadway reconfiguration the existing layout would remain. This alternative would provide approximately 320 public parking spaces within the bounds of Terminal Boulevard and 625 spaces outside. Rental car storage would be expanded near the wash facility and employee parking would be expanded in its existing location. This alternative can provide more parking spaces than required to meet the 20-year planning period although construction could be staged so that parking spaces are provided as needed.

4.12.2 Vehicle Parking Alternative 2: Parking Garage

This alternative would expand some of the parking spaces in undeveloped areas in addition to constructing a parking garage in the southeast section of the main parking lot, as shown in **Exhibit 4-15**. Terminal Boulevard would be expanded slightly to allow for the garage but would remain independent of Jetway Avenue. The parking garage would provide approximately 450 parking spaces and would be constructed so that it would not obstruct the view of the terminal for people entering from University Drive. In addition to preserving the view of the terminal, this would aid in wayfinding for those unfamiliar with the Airport. Like Alternative 1, this alternative would provide more spaces than needed to fulfill the 20-year parking demand, but the parking lot expansion near University Avenue could be constructed in stages to meet demand as it grows. Although a parking garage is spatially efficient and requires a smaller footprint than ground level parking, the cost for space is significantly more expensive. As there is sufficient space to develop additional ground level parking without interfering with surround facilities, this alternative is not considered to be necessary now.

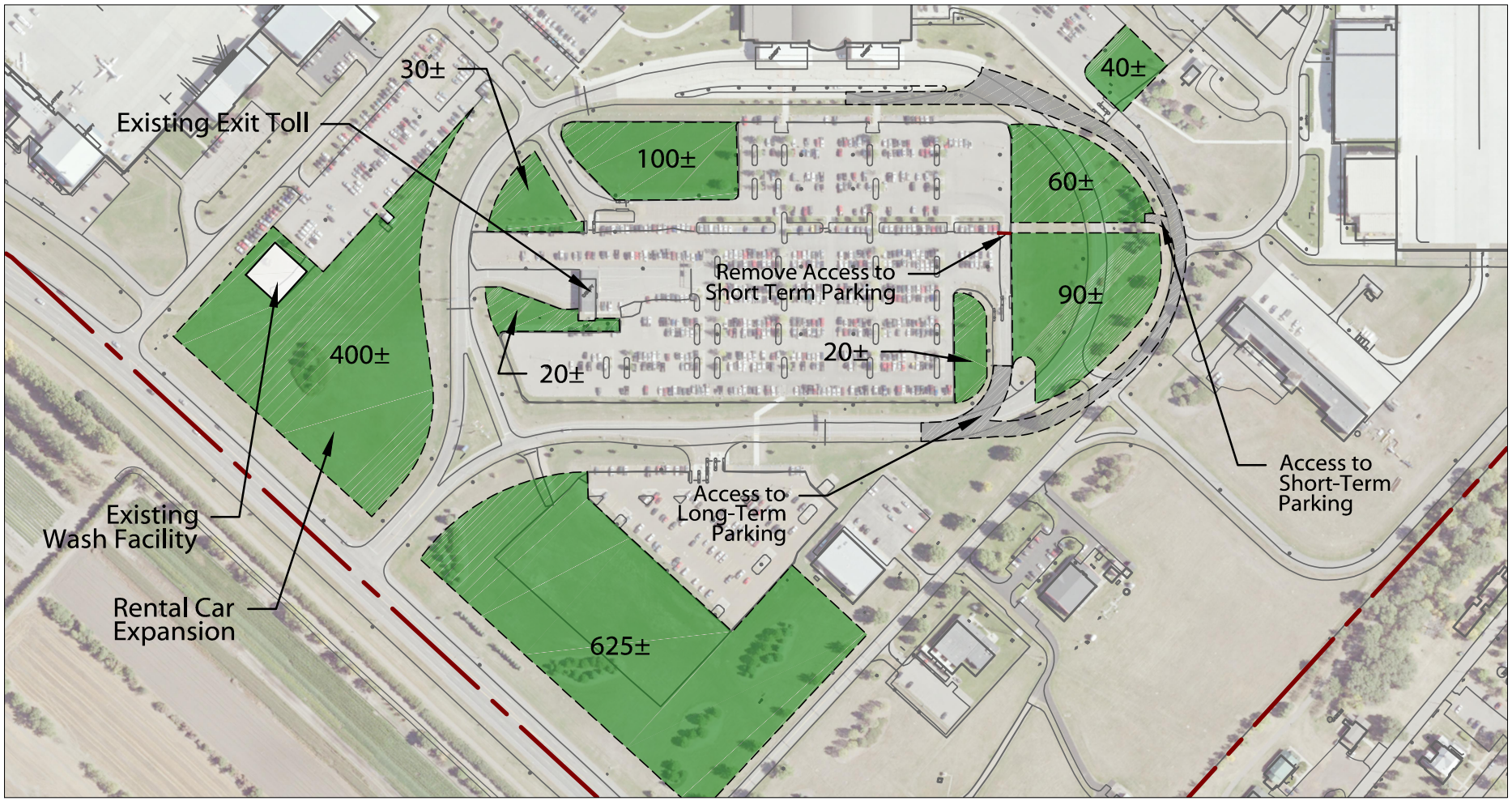

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Exhibit 4-14 **Parking Alternative 1 - Expansion**

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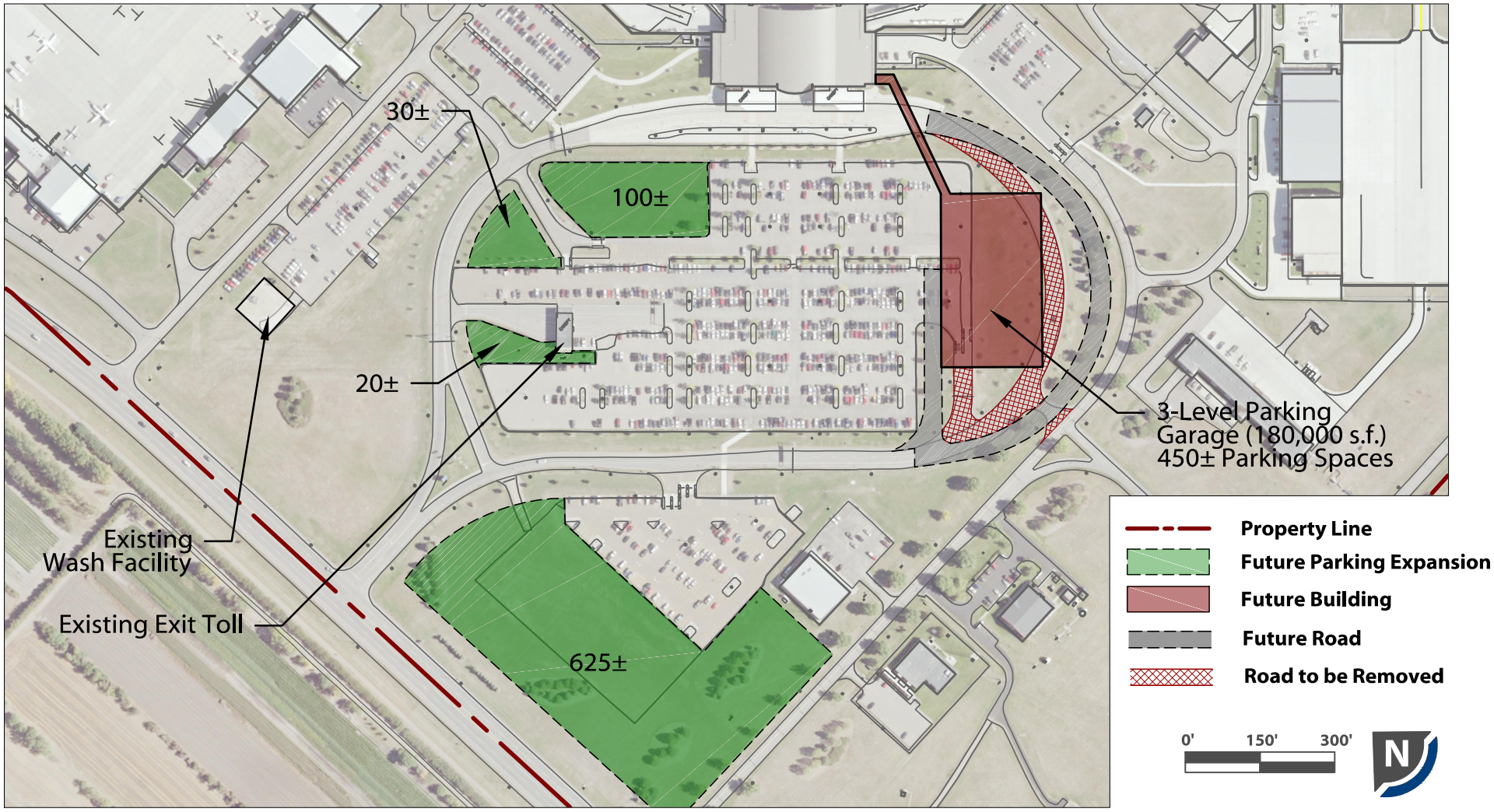

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Exhibit 4-15 **Parking Alternative 2 - Parking Garage**

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4.13 LANDSIDE ALTERNATIVES SUMMARY

Each of the recommended landside alternatives have been incorporated into two alternative concepts shown in **Exhibit 4-16** and **4-17**. The purpose of these landside summary alternatives is to demonstrate the overall build out of the Airport's landside facilities through 2036. The primary difference between these two summary alternatives is the proposed configuration of a new concourse expansion and the layout of a new SRE building with support apron area. Based on the individual landside facility recommendations presented, Landside Alternative Summary 2 has been selected as the preferred landside alternative and will be carried forward in the development of the Airport Layout Plan.

4.14 SUMMARY OF ALTERNATIVES

Overall, the Airport is well positioned to be able to expand and improve its infrastructure so that the demands of its users are met throughout the next 20-years. The following summarizes the recommended alternatives to address these needs. Again, it should be noted that the selection of the recommended alternatives is based on the most logical option to address a facility need, or was the best option in comparison with operational, economic, environmental, sustainable, and implementation factors of other alternatives prepared for a facility need. A graphic summary of the recommended alternatives to address the Airport's facility needs is presented in **Exhibits 4-16** and **4-17**. A narrative description of each facility need is summarized below.

- **Runways** – Few changes required as the width and length for each runway are sufficient for the planning period. Expansion of blast pads to 200 feet wide by 200 feet long for both runways.
- **Taxiways** – As shown previously in **Exhibit 4-2**, only minor taxiway modifications are recommended. These include reducing the width of Taxiways C3 and C4 to meet ADG V and IV design standards, respectively. In addition, the taxiway fillets connecting Runway 13/31 to C3 and C4 will be reduced in width to comply with current design

standards while continuing to serve the forecasted aircraft fleet mix over the next 20-years. Each of these improvements have been approved by FAA under the runway rehabilitation project currently underway at BIS. In addition, it is recommended that paved island near Taxiway C3 be remarked to require pilots to make a turn before accessing the air carrier apron. Remarking this paved area will reduce the potential for aircraft incursions.

- **GA Development Areas** – As shown in **Exhibit 4-7**, it is recommended that additional hangars be developed near Taxiway B to accommodate future demand for piston aircraft. The expansion of hangars near Taxiway B is consistent with the long-term development plans of the Airport. As depicted in **Exhibit 4-8**, the expansion of corporate hangars is in two primary areas, north and south. Expansion to the North supports the continuation of corporate hangars parallel to University Avenue. Expansion to the South is concentrated within the existing corporate hangar located along Taxiway E. The recommended development of these GA development areas maintains the existing separation of smaller piston aircraft from larger turbine and jet aircraft throughout the 20-year planning period.
- **Terminal Building** – Two terminal expansion alternatives were developed to address the need for a total of eight aircraft gates by 2036. As shown in **Exhibit 4-10**, a new concourse extending northward towards Taxiway C enables the development of eight gates; however, the remaining space between the tail of an aircraft parked at the end gates and the TOFA creates significant challenges for repositioning aircraft from one side of the concourse to the other. In addition, snow removal becomes very challenging under a pier concourse expansion. In both instances, the ATCT would have to be contacted before encroaching the TOFA. The preferred terminal expansion alternative, shown in **Exhibit 4-12**, expands the existing terminal building both northwest and southeast and includes a new linear concourse to the south capable of up to 11 gates. Extending the concourse to the southeast can be phased to meet future demand beyond the 20-year planning period. The linear concourse extension does not impact the Taxiway C TOFA and would not require ATCT contact to reposition aircraft or impact snow removal.
- **SRE Facility** – Two SRE alternatives were developed to meet the future needs of BIS. As shown in **Exhibit 4-5**, expanding the existing SRE building and support apron to

the south can accommodate the short-term needs of the Airport. Similarly, **Exhibit 4-6** depicts a second short-term SRE alternative which extends the existing SRE building to the northwest and provides an expanded apron area also located to the northwest. This option provides additional storage space within the existing footprint of the current SRE; however, the expansion of the supporting apron is significantly larger to promote improved circulation. To meet short-term SRE needs, it is recommended that the Airport expand the existing SRE to the northwest (**Exhibit 4-6**). Long-term, it is recommended that the Airport consider the development of a new SRE facility southeast of the ARFF.

- **Fuel Facility** – It is recommended that the Airport increase its fuel storage capacity within the 20-year planning period to meet future demand. Adequate room within the existing fuel farm area is available to accommodate additional fuel storage tanks. Both landside **Exhibits 4-16** and **4-17** depict the recommended location for future fuel tanks.

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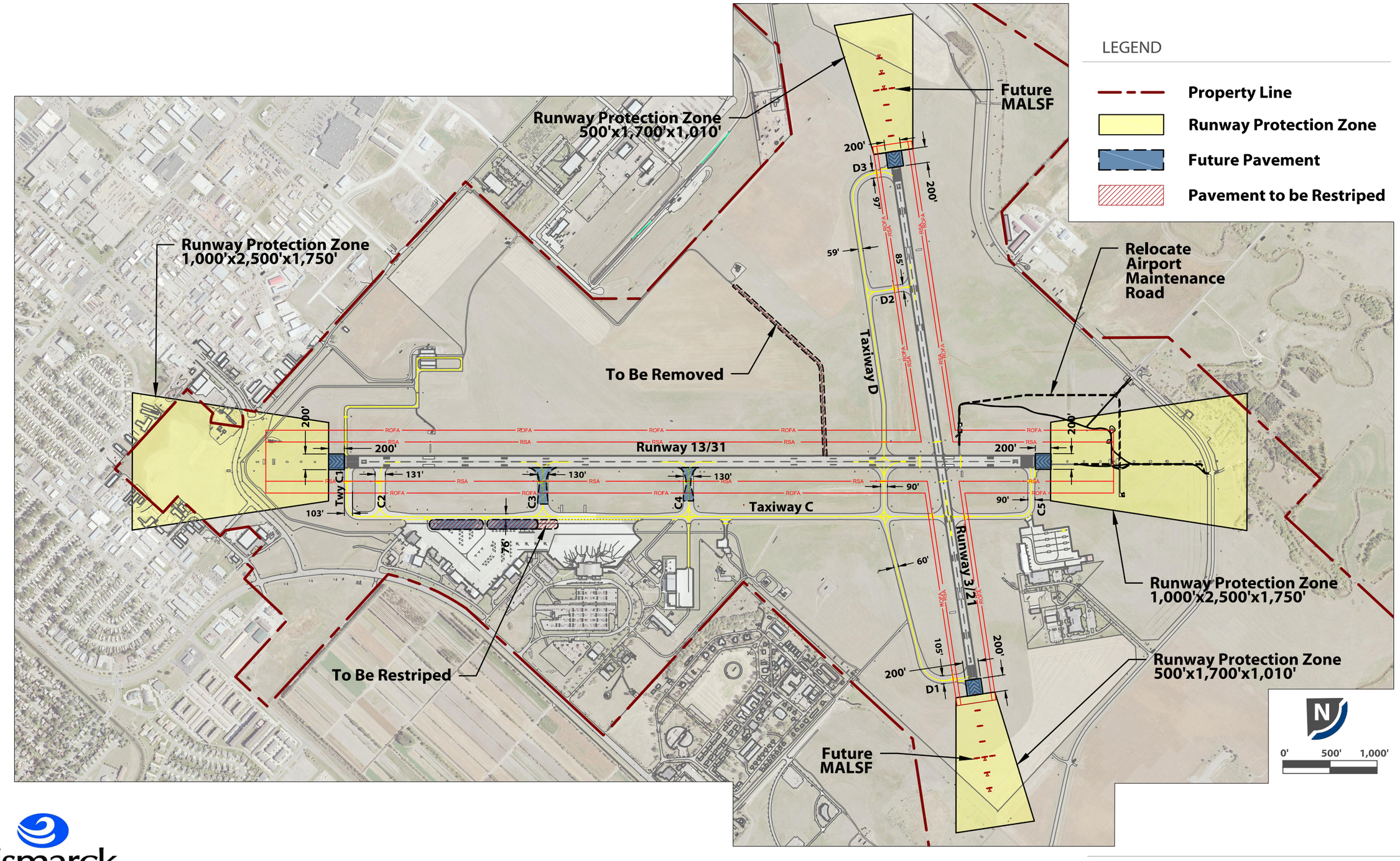

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Exhibit 4-16 **Airside Preferred Alternatives**

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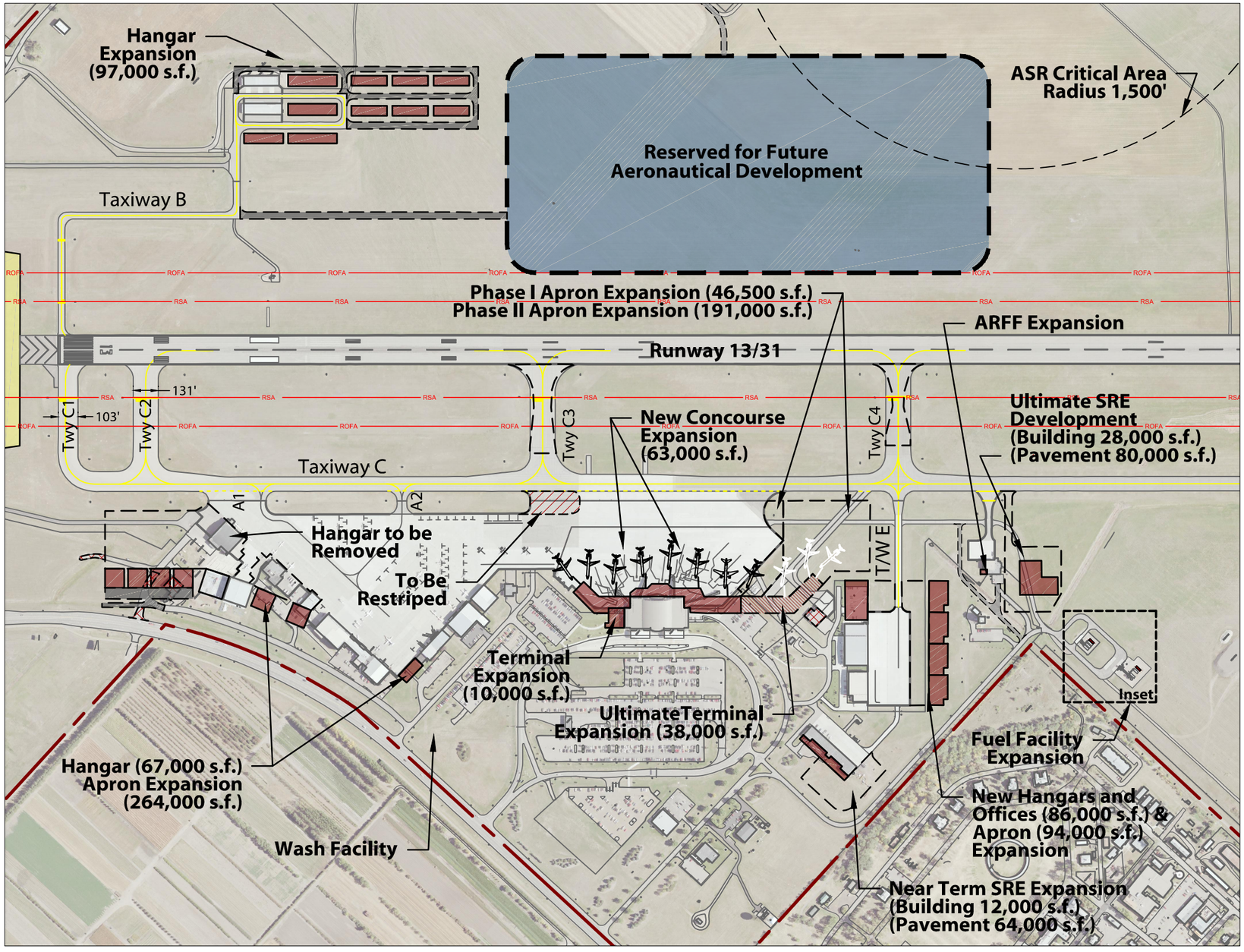

LEGEND

- Property Line
- Future Building
- Ultimate Terminal Expansion (Beyond 20-Year Planning Period)
- Future Pavement
- Development Area
- Pavement to be Restriped
- Pavement to be Removed

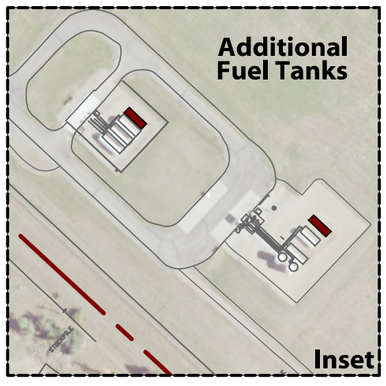

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Exhibit 4-17 **Landside Preferred Alternatives**

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MASTER PLAN UPDATE

Bismarck AIRPORT

5 Environmental Overview

5.0 ENVIRONMENTAL ANALYSIS

This chapter is a summary of the environmentally sensitive features of the Bismarck Airport (BIS) and the potential impacts anticipated from the proposed development plan. Readily available resources provided this information, and this chapter constitutes a preliminary overview of environmental resource categories within Federal Aviation Administration (FAA) Order 1050.1F, Environmental Impacts: Policies and Procedures, FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions, FAA Advisory Circulars and applicable federal, state, and local regulations. While all the NEPA categories are generally addressed, the analysis was deeper for those that are critical to airport master planning.

This environmental overview is not intended to substitute for a NEPA document; however, it is intended to provide information on environmental resources applicable to BIS. The effort did not include field investigations (i.e., cultural resource studies or wetland delineations). Full NEPA-level review (through the development of a Categorical Exclusion, Environmental Assessment [EA] or Environmental Impact Statement), will likely be required project by project as the development plan is implemented.

The information is organized into these sections:

5.1 Noise
5.2 Land Use
5.3 Land Use Controls
5.4 GIS Airspace Tool
5.5 Historical and Archeological
5.6 Water Quality
5.7 Fish, Wildlife, and Plants
5.8 Hazardous Materials

5.9 Solid Waste and Recycling
5.10 Wetlands
5.11 Other Environmental Considerations
5.12 Construction Impacts
5.13 Conclusion
5.14 Noise

5.1 NOISE

Noise is unwanted sound that, at an airport, is generally associated with the operation of aircraft. Some land uses are more sensitive to noise than others, for example, residential, educational, health, religious, recreational, cultural, and historic areas or sites. As a result, the FAA established the Day Night Average Sound Level (DNL) metric to evaluate the impact of aircraft noise on land uses surrounding an airport. DNL is the loudest average sound level in decibels (dB) from an airport's average 24-hour operational day. A 10-dB noise penalty is added to each aircraft operation that occurs between 10 p.m. and 7 a.m. to account for the heightened sensitivity of noise during nighttime hours. The locations of DNL contours identify the level of noise impact on the surrounding community.

Some noise sensitive land uses can be found near BIS. Areas north and west of BIS contain residential development, including single-family housing, multi-family housing, and manufactured home communities. Residential development in other locations around BIS is limited to rural, single-family housing.

Six schools and three churches are located within or close to a 1-mile radius of BIS. **Table 5-1** identifies these facilities and their proximity to BIS.

Table 5-1 Proximity of Schools and Churches to BIS		
Facility Name	**Distance**	**Location**
Luther Preschool	0.75 miles	Northwest of BIS
Theodore Jamerson Elementary	1.2 miles	West of BIS
United Tribes Technical College	0.9 mile	West of BIS
Wachter Middle School	0.8 miles	Northwest of BIS
Jeannette Myhre Elementary School	0.72 miles	Northwest of BIS
Dorothy Moses Elementary School	1 mile	Northwest of BIS
Bismarck Community Church	0.75 miles	North of BIS
Ascension Church	0.75 miles	West of BIS
Shepherd of the Valley	0.75 miles	Northwest of BIS

Source: Mead & Hunt, Inc (2019)

There are no hospitals within the vicinity of BIS. More detail about the recreational and historical sites appears in **Section 5.2.5. Department of Transportation Section 4(f) Lands** and **Section 5.5. Historical and Archeological** of this chapter. When considering proposed actions during the NEPA process, FAA Order 1050.1F, Desk Reference, requires a noise analysis if one or more of the following conditions are met:

- Airports have at least 90,000 annual operations by propeller driven Airplane Design Group (ADG) I and II aircraft within Aircraft Approach Categories (AAC) A through D.
- Airports have at least 700 annual jet operations.
- Helicopter operations exceed 10 operations per day, and hover times are at least two minutes.

According to the FAA's Traffic Flow Management System Counts (TFMSC) database, in 2017 BIS had:

- 3,198 Instrument Flight Rules (IFR) piston operations
- 6,453 IFR turbine operations
- 12,579 jet operations.

Because the number of jet operations fall within the FAA criteria for noise analysis, future development actions that prompt changes to aircraft movement, airspace, or air traffic procedures may require noise analysis during the environmental review process. Two methods that are often used to determine if noise impacts would result are the Area Equivalent Method or modeling with the Aviation Environmental Design Tool (AEDT). If proposed actions will result in an overall increase in daily traffic or the use of larger or noisier aircraft without any changes to ground tracks or flight profiles, an initial screening using the Area Equivalent Method can be completed. In other cases, noise contours are modeled using the AEDT.

BIS noise exposure levels and surrounding land uses were analyzed for a previous FAR Part 150 Noise Compatibility Plan. The 65 DNL contour developed at the time of the Part 150 is shown in **Figure 5-1**. Contours developed during the Part 150 were used to create the Airport Noise Overlay District for the City of Bismarck, which encourages land uses that are compatible with BIS noise exposure. Permitted uses within the district include manufacturing, transportation, communication, utilities, trade, many types of services, and some cultural and recreational uses. Most residential use is prohibited, with the exception of hotels and pre-existing lots-of-record.

The contours developed for the FAR Part 150 study remain relevant and facilitate the noise overlay zoning that protects land use compatibility near BIS. Public assembly

facilities including schools and churches within 1 mile of the airport remain outside areas of significant noise exposure. The recommended developments within the planning horizon are not expected to significantly affect noise contours or negatively impact sensitive land use areas. As a result, the current 65 DNL noise contours accurately reflect present day noise exposure levels.

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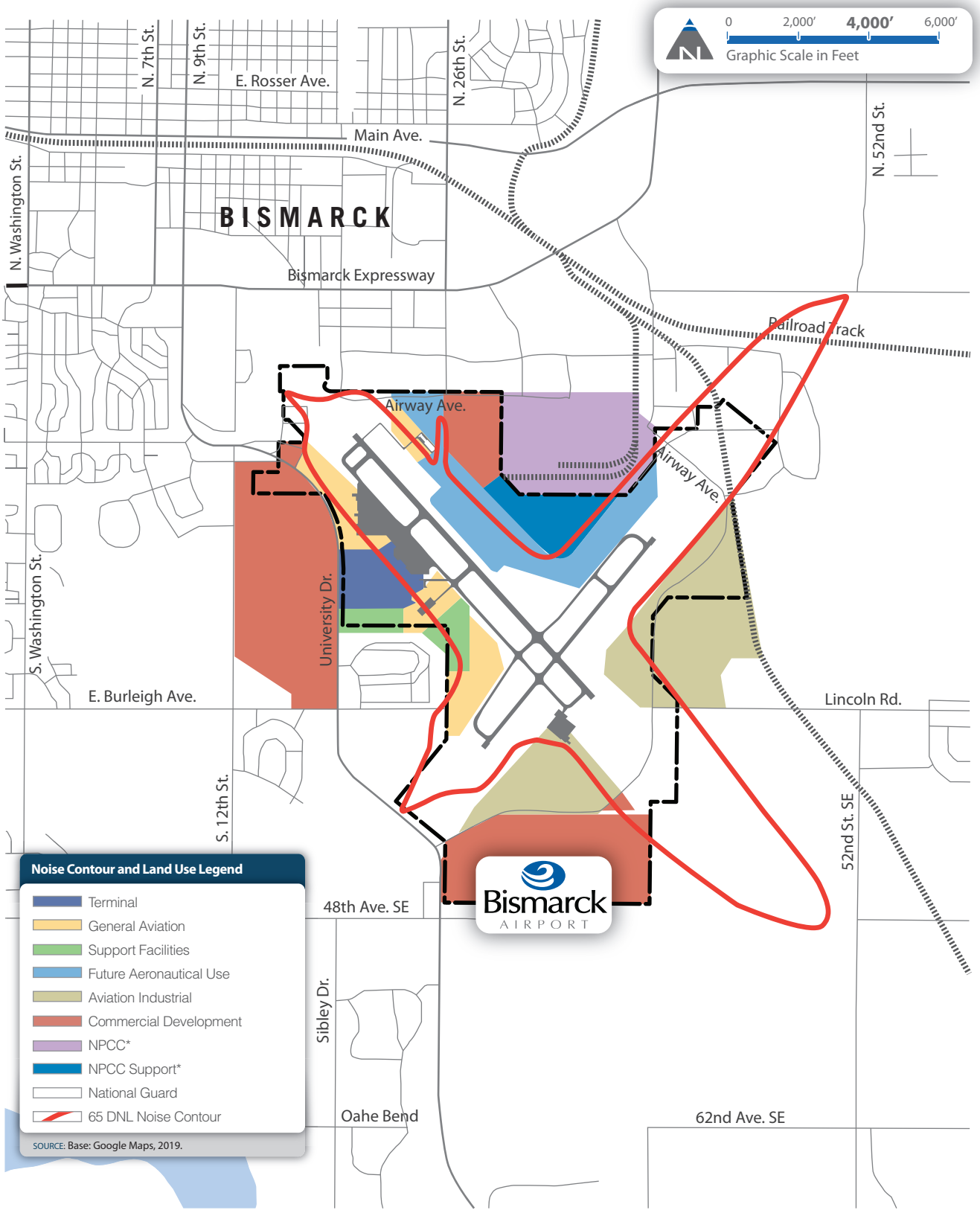

Figure 5-1 **Noise Contour and Land Use Map**

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5.2 LAND USE

The relationship between land use and airport activities is complex since each can affect the other. Ideally, airports set a goal of achieving compatibility with those land uses surrounding it to protect the airport and its users, avoid hazards, and protect the people living and working nearby. Often, existing and/or planned land use compatibility is associated with noise impacts and affects residential and commercial relocations as well as modifications to local roads and travel patterns within the vicinity of an airport.

Laws and policies at state, federal, and local levels encourage compatible land uses near airports and identify what makes land use compatible. The FAA, the State of North Dakota, and local government entities establish the rules and regulations for compatible land use near BIS. Section 1502.16(c) of the Council on Environmental Quality (CEQ) Regulations requires the discussion of "possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies, and controls for the area concerned" in environmental review documents. Under the Airport and Airway Improvement Act of 1982, to receive federal funding for airport actions, sponsors must provide specific assurances to the FAA. Assurances related to land use include:

- Consistency with local plans
- Mitigation and prevention of airport hazards
- Public access to project information and the planning process
- Adoption of zoning laws that increase land use compatibility.

These are some land uses that are least compatible with airports:

- Densely populated residential or office buildings
- Streetlamps and structures that emit bright light

- Dust-producing smokestacks that cause visual and physical obstructions
- Ponds and large wetlands that attract wildlife.

Some farmland, residential developments, and places where people gather in large numbers as well as land uses sensitive to light or air emissions may also be incompatible with airport activities. Careful planning will spur land use, and development around an airport can be accommodated and encouraged.

The FAA directs airport sponsors to seek opportunities to promote compatible land uses and zoning measures adjacent to airport property. FAA policies instruct airports to own and control, where feasible, affected land surrounding an airport to maintain compatible land use. Because all airports do not have land use control authority, the FAA encourages the promotion of compatible land uses through other means, such as working with local authorities to persuade adjacent jurisdictions to enact airport-compatible zoning near airports.

5.2.1 General Land Use

BIS occupies 2,425 acres within Bismarck city limits, south of Interstate Highway 94, between the Missouri River to the west and Apple Creek to the east. The city's most developed areas are north of BIS, which is surrounded by existing land use that is varied and diverse. The primarily residential area northwest of BIS includes traditional single-family and mobile home neighborhoods. Commercial businesses north of BIS consist primarily of retail shopping centers and the Northern Plains Commerce Centre (NPCC) which is located directly northeast of Runway 13-31. Manufacturing enterprises are northeast, with smaller manufacturing operations also found northwest and southwest of BIS property. Outside the residential, commercial, and manufacturing uses already described east, south, and west of BIS, the remaining land is home to agricultural activity. The agricultural land consists of farm and ranch land as well as Lincoln Oaks Nursery

and North Dakota Soil Conservation Forestry Property. Land use near BIS is shown in **Figure 5-1**.

In addition to the churches and schools nearby, three parks, featuring soccer and baseball fields, are within the area. More detail about the churches and schools is in **Section 5.1 Noise** (above), and more detail about the parks is to come in **Section 5.2.5 Department of Transportation Section 4(f) Lands**. Area historical sites will be described in **Section 5.5 Historical and Archeological**.

The review of area maps indicates no hospitals, theaters, stadiums, or campgrounds are within the immediate vicinity of BIS. Review of local land uses did not indicate uses that could cause a significant visual distraction to pilots such as lighting, reflective materials, smoke or steam, or dust. For example, a small asphalt manufacturing plant site is located northeast of BIS but does not conduct activities which impact aircraft approaching the runways.

Land Use within the Runway Protection Zones

In addition to the general land uses around an airport, it is important to consider the land uses within certain areas beyond the end of each runway. The FAA offers specific guidance concerning land uses within the Runway Protection Zone (RPZ). An RPZ is a trapezoidal-shaped area beyond a runway end established to protect pilots and individuals and property on the ground. Characteristics that determine the size of this zone are the design of the runway, the types of aircraft most frequently using the runway, and the visibility minimums for runway instrument approach procedures.

FAA Advisory Circular (AC) 150/5300-13A, *Airport Design*, states, “It is desirable to clear the entire RPZ of all above-ground objects. Where this is impractical, airport owners, at a minimum, should maintain the RPZ clear of all facilities supporting incompatible

activities." On September 27, 2012, the FAA Office of Airports issued the memorandum "Interim Guidance on Land Uses Within a Runway Protection Zone," which further clarifies incompatible land uses. Airport sponsors and their consultants must consult with the FAA when planning new or changed uses within an RPZ or planning changes to an RPZ size or location. Land uses planned within an RPZ that require FAA consultation include:

- Buildings and structures
- Recreational land uses
- Transportation facilities
- Fuel storage facilities
- Hazardous material storage
- Wastewater treatment facilities
- Above-ground utility infrastructure.

Review of BIS's surfaces found that the RPZs for Runway 3/21 lie within the BIS property line. The RPZ for Runway 3, which is mowed and maintained, includes a portion of an agricultural field and the Airport security fence. The RPZ for Runway 21, which is also mowed and maintained, has easements for electrical, gas, and telephone utilities running beneath it.

The RPZs for Runway 13/31 include areas both on Airport property and outside the property line. The Runway 13 RPZ contains a perimeter road, security fence, and public roadway (Airport Road) on 42 acres within the BIS perimeter fence. The remaining 37 acres of this RPZ are outside the BIS perimeter fence. Of the 37 acres outside the perimeter fence, approximately 34.5 acres are owned and under the control of BIS. The remaining 2.5 acres are owned by others and contain buildings associated with local businesses, including a kennel club, florist, consignment store, and rental storage units. Small sections of four local roadways, Continental Avenue, Airway Avenue, Cessna Avenue (formerly Piper Avenue), and Park Avenue lie within this RPZ. BIS has avigation

and hazard easements in place for most parcels outside the perimeter fence and is pursuing acquisition for parcels of property currently outside of these controls.

Nearly all the Runway 31 RPZ lies within property owned and controlled by BIS. Airport property. A small creek (Apple Creek) and portions of its associated floodplain, two fences, a public road (Airway Avenue), several trees, and one of two nearby grain bins are located within this RPZ.

Runway 13 currently offers an instrument approach with ¾ mile visibility limitations. If visibility minimums are lowered in the future, the size of the RPZ for Runway 13 may increase. If the RPZ changes in size or location, or future development in the RPZ will alter existing land use, it is likely that an RPZ Alternatives Analysis will be required due to the presence of incompatible uses within the RPZ limits.

5.2.2 Zoning

Zoning is a planning technique where certain land uses are permitted for specific areas of land. Zoning can assist in planning for compatible land use around an airport. The City of Bismarck is responsible for zoning most of the land at and around BIS; Burleigh County is also responsible for a portion of this area. According to a City of Bismarck Zoning District Map, BIS property is zoned District P – Public Use. This zoning designation is also shown on the Burleigh County Zoning Map. Airports are permitted as a special use within District P. This is discussed in more detail in **Section 5.3 Land Use Controls**.

Review of the City and County zoning maps and ordinances found several districts within a one-mile radius of BIS. **Table 5-2 Zoning Around the Airport** lists the zoning designations found around BIS.

Table 5-2 Zoning Around the Airport	
Area	**Zoning**
Airport Property	▪ Public Use (P)
North of the Airport	▪ 100-Year Floodplain (AE and 0.2% Annual Chance Flood Hazard) ▪ Light Industrial (MA) ▪ Manufactured Home Park (RMH) ▪ Public Use (P) ▪ Two Family Residential (R10) ▪ Planned Unit Development (PUD)
East of the Airport	▪ 100-Year Floodplain (AE and 0.2% Annual Chance Flood Hazard) ▪ Heavy Industrial (MB) ▪ Agricultural (A) ▪ Rural Single Family Residential (RR)
South of the Airport	▪ 100-Year Floodplain (AE and 0.2% Annual Chance Flood Hazard) ▪ Public Use (P) ▪ Light Industrial (MA) ▪ Agricultural (A) ▪ Rural Single Family Residential (RR)
West of the Airport	▪ 100-Year Floodplain (AE and 0.2% Annual Chance Flood Hazard) ▪ Agricultural (A) ▪ Heavy Commercial (CG) ▪ Rural Single Family Residential (RR) ▪ Manufactured Home Park (RMH) ▪ Multi-Family Residential (RM – 10, 15, 30) ▪ Public Use (P) ▪ Light Industrial (MA) ▪ Two-Family Residential (R10) ▪ Single Family Residential (R5)

Source: City of Bismarck and Burleigh County Zoning Maps

City of Bismarck ordinances indicate that there is an Airport Noise overlay district that corresponds with the 65 DNL contours from the existing FAR Part 150 Noise Compatibility Plan. This was discussed in **Section 5.1 Noise** above. A portion of the area east of BIS is outside the City and County zoning jurisdictions and subject to Lincoln Township zoning. According to the City of Lincoln Zoning Map, the city limit is located approximately

1 mile east of the Airport property line. The western portion of Lincoln is zoned for Agriculture (A), Planned Unit Development (PUD), Heavy Commercial (CG), Public Use (P), and Rural Single Family Residential (RR-1).

5.2.3 Wildlife Attractants

Certain land uses have the potential to attract wildlife near airports, such as birds, deer, coyotes, that can be hazardous to aircraft operations. These are examples of the types of land uses that attract wildlife:

- Drinking, storm, and wastewater facilities and associated retention ponds
- Recreational water bodies
- Wetlands
- Agricultural activities
- Other areas that provide food, water, and/or shelter/cover for wildlife.

FAA AC 150/5200-33B, *Hazardous Wildlife Attractants On or Near Airports*, addresses the standards for separation distances between landfills and airports. Specifically, the FAA notes that solid waste landfills and water management facilities attract increased populations of birds, which can pose a hazard for wildlife strikes. Because of this, "The FAA recommends a separation distance of 10,000 feet for new airport development projects meant to accommodate aircraft movement" from municipal solid waste or water management facilities. According to maps of the area, there are no active landfills or wastewater treatment facilities within 1 mile of BIS. The nearest landfill is located about 4 miles to the north-northeast (Bismarck City Landfill). Based on review of aerial mapping, three ponds or lagoons are located off Airport property southwest of Runway 3 and four ponds or lagoons, off Airport property east of Runway 21. The plants and trees grown at a local plant/tree nursery west of the Airport could attract wildlife. The agricultural areas noted under **Section 5.2.1 General Land Use** are used to grow and harvest row crops.

Other wildlife attractants such as surface waters and wetlands near BIS will be described in **Section 5.6 Water Quality**.

The presence of these wildlife attractants requires a management plan to keep birds and animals that may be likely to enter Airport property from becoming hazards. Efforts include barriers such as fencing, vegetation management, removal of attractive habitat, and other types of deterrents. More information about the Airport's wildlife hazard management program can be found in the *2015 Bismarck Airport Wildlife Hazard Management Plan* and *2013-2014 Wildlife Hazard Assessment of the Bismarck Airport*. BIS reassesses the wildlife hazard management program regularly to account for and address new hazards or changes in conditions over time.

5.2.4 Department of Transportation Section 4(f) Lands

Department of Transportation (DOT) Act, Section 4(f) properties are publicly owned parks, recreational areas, wildlife and waterfowl refuges, and historic sites that are protected by the DOT Act of 1996 (now codified at 49 U.S.C. § 303).

The Act states that the Secretary of Transportation may approve a transportation project requiring the use of a publicly owned park, recreational area, or wildlife and waterfowl refuge of national, state, or local significance, or land of a historic site of national, state, or local significance under these circumstances:

- If there is no prudent and feasible alternative that would avoid using those resources.
- If the project includes all possible planning to minimize harm to the site.

Cottonwood Park, Sons of Norway Park, and Tatley-Eagles Park are community resources within a 1-mile radius of BIS that fit these criteria.

Cottonwood Park encompasses more than 200 acres and is approximately 0.5 miles west of BIS. This park has facilities for bocce ball, softball, and baseball. Over time, improvements to the baseball field include lights, batting cages, a press box, a ticket booth, and a scoreboard. According to the North Dakota Parks and Recreation department website, Cottonwood Park received federal grant funding from the Land and Water Conservation Fund in fiscal year 2018. Because federal funds were used, Cottonwood Park is also protected by Section 6(f). Section 6(f), administered by the National Parks Service, requires that land funded through the program remain available for public outdoor recreation use or be replaced by lands of equal value, location, and recreation usefulness.

Sons of Norway Park consists of approximately 5 acres and is approximately 0.6 miles northwest of BIS. This park has two picnic shelters, a skate park, a softball field, and a replica of a Norwegian farm storage house (stabbur).

Tatley-Eagles Park is approximately 0.8 miles north of BIS and encompasses approximately 19 acres. This park features baseball diamonds, a playground, restrooms, a warming house, skating rinks, sand volleyball courts, and community gardens.

The elementary and middle schools within a 1-mile radius of BIS also have playgrounds or other recreational features. Potential 4(f) resources near BIS are shown in **Figure 5-2**.

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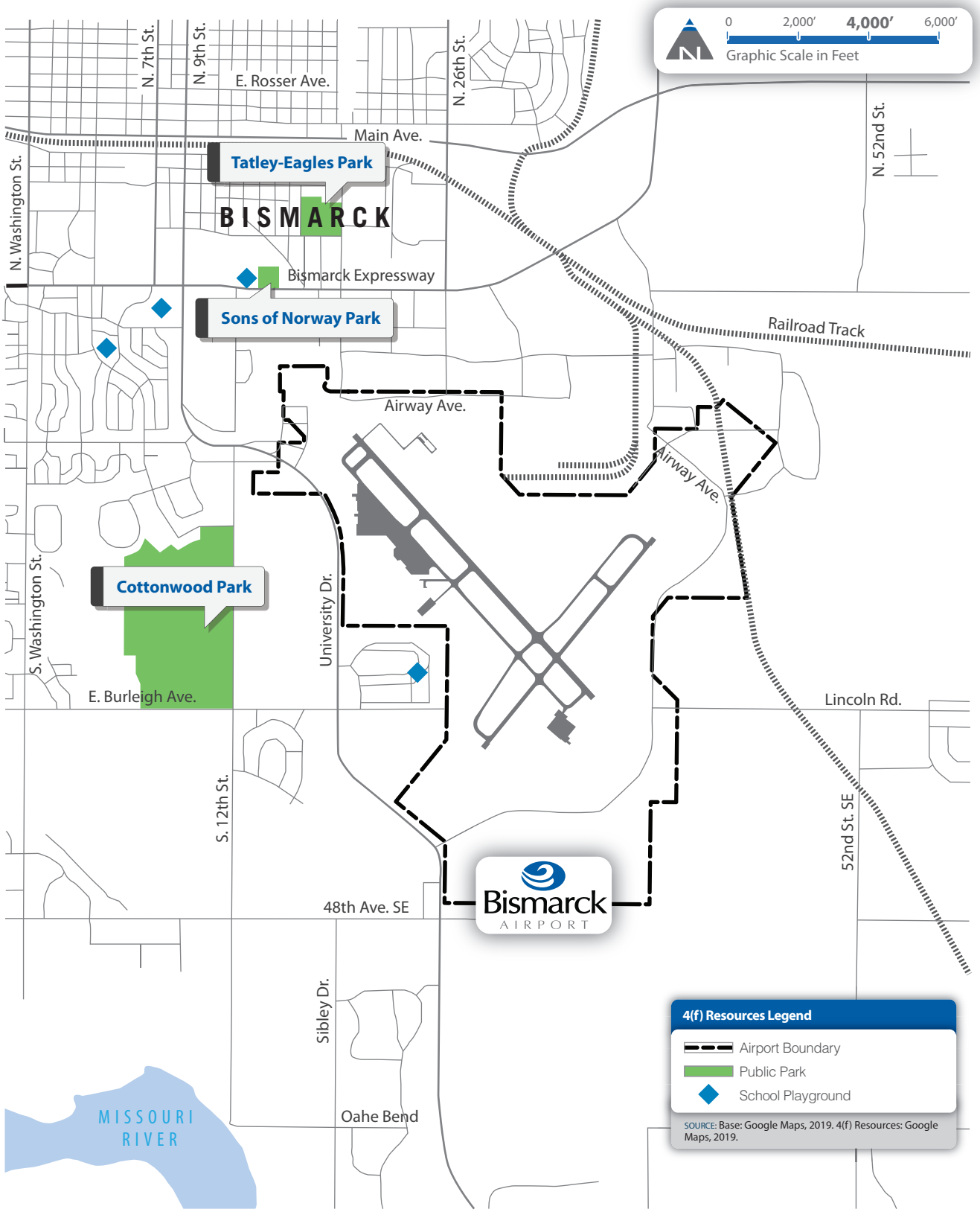

Figure 5-2 **Location of 4(f) Resources**

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Based on an Information for Planning and Conservation (IPaC) *Trust Resources Report*, there are no listed wildlife refuges or wildlife management areas within the vicinity of BIS. Area historic sites will be discussed under **Section 5.5 Historical and Archeological**.

Projects proposed under the Master Plan are not anticipated to cause physical "taking" or constructive use of Section 4(f) lands in the area because the proposed development would occur on existing Airport property.

5.2.5 Floodplains

A floodplain is a flat, low area, adjacent to a stream, river, or creek, that may flood during high water flow conditions. A 100-year floodplain includes the area that has a 1 percent chance of flooding in any given year. Projects within a 100-year floodplain are discouraged.

The City and County zoning maps indicate that portions of Airport property as well as the area near the Airport contain floodways and are within a 100-year floodplain. For further confirmation, review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) encompassing the Airport (**Figure 5-3**) was necessary. The review shows the bulk of a 100-year floodplain and a floodway associated with Apple Creek on Airport property near the runway intersection as well as east, northeast, and southeast of the property boundary. This FIRM also shows other flood areas adjacent to airfield pavement, a floodway associated with Apple Creek, and a floodplain associated with Cottonwood Park Pond.

FEMA regulations stipulate that any development in the floodplain must not increase the base flood elevation by more than 12 inches. The projects proposed under this Master Plan are not anticipated to impact floodplains; however, further analysis may be required project by project for proposed actions located within a designated flood hazard area.

5.2.6 Farmlands

The Farmland Protection Policy Act of 1981 (FPPA) was enacted to minimize the extent to which federal actions and programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses. Farmland can be classified as "prime farmland," "unique farmland," or "farmland that is of statewide or local importance," pursuant to the FPPA. Prime farmland has the best combination of physical and chemical characteristics for producing food, forage, fiber, and oilseed crops. Unique farmland is defined as land other than prime farmland that is used to produce specific high-value food and fiber crops such as citrus, tree nuts, olives, cranberries, fruits, and vegetables. Farmland of statewide or local importance includes soils that do not meet prime farmland criteria, but economically produce high yields of crops when treated and managed. Any federal action that may result in conversion of farmland to a non-agricultural use requires coordination with the United States Department of Agriculture Natural Resource Conservation Services (NRCS).

According to the NRCS Web Soil Survey Data Explorer, BIS property contains prime farmland (32 percent, 695 acres) and farmland of local importance (34 percent, 736 acres) with the remainder designated as not prime farmland (35 percent, 759 acres). **Figure 5-4** presents a farmland classification map generated from the NRCS Web Soil Survey Data Explorer.

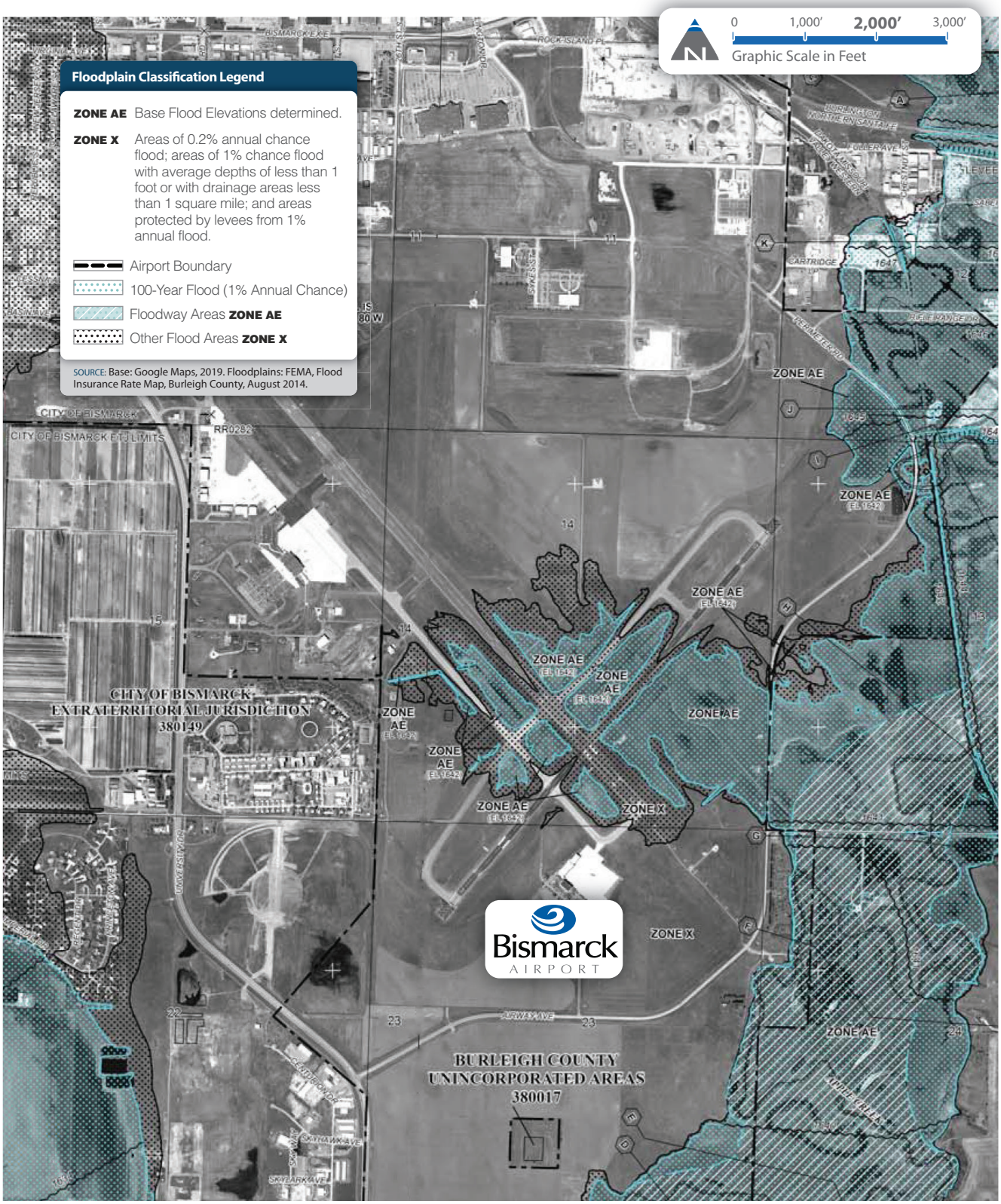
Floodplain Classification Legend
ZONE AE Base Flood Elevations determined.
ZONE X Areas of 0.2% annual chance flood; areas of 1% chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual flood.
Airport Boundary
100-Year Flood (1% Annual Chance)
Floodway Areas ZONE AE
Other Flood Areas ZONE X
SOURCE: Base: Google Maps, 2019. Floodplains: FEMA, Flood Insurance Rate Map, Burleigh County, August 2014.
0 1,000' 2,000' 3,000'
Graphic Scale in Feet
CITY OF BISMARCK
CITY OF BISMARCK ETJ LIMITS
CITY OF BISMARCK EXTRATERRITORIAL JURISDICTION 380149
BURLEIGH COUNTY UNINCORPORATED AREAS 380017
ZONE AE
ZONE X
Bismarck AIRPORT

Figure 5-3 **Floodplain Map**

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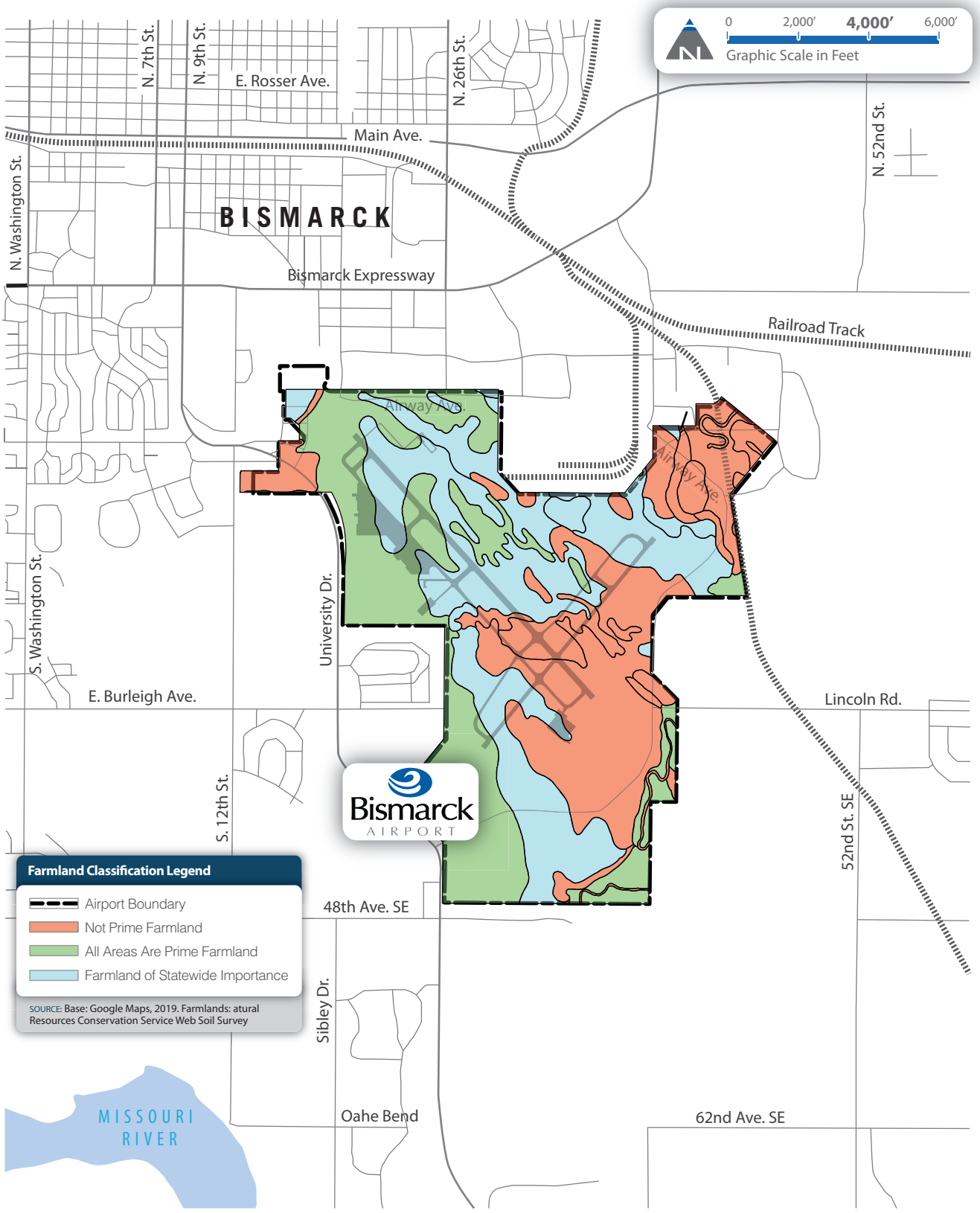

Figure 5-4 **Farmland Classification Map**

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The Farmland Protection Policy Act exempts farmlands "already in or committed to urban development… [including] lands identified as 'urbanized area' on the Census Bureau Map." According to the 2010 Census Urbanized Area Reference Map for Bismarck, North Dakota, BIS is included in the urbanized area associated with the City of Bismarck; therefore, it is anticipated that the farmland at the Airport is exempt from the Act.

5.2.7 Land Use Summary

In summary, land use within the City of Bismarck, Burleigh County, and nearby townships is largely compatible with the neighboring Airport. While there are pre-existing residential areas near the northwest side of BIS, zoning around the airport does not include sensitive uses, meaning that conflicts are unlikely to develop in the future. Some areas in the RPZs are not yet under Airport control, but BIS is pursuing acquisition of this land to ensure compatibility in the future. Land use compatibility should be continually reviewed throughout the planning period to confirm land uses surrounding BIS are compatible with its operations. BIS should work with nearby jurisdictions to ensure that any land currently designated as farmland or open space is zoned appropriately if it comes under development in the future.

5.3 LAND USE CONTROLS

The City of Bismarck has an airport height limit zoning ordinance in place that regulates the height of structures and trees on and near the Airport. Recommendations for updating this ordinance are found in **Section 5.4 GIS Airspace Tool**.

Airport property is zoned as a Public Use district (P). This district is meant to "encourage the continued use of the land for public recreation, education and other government services... [and] To prohibit residential, commercial and industrial uses of the land, and to prohibit any use of the land which would diminish its value in serving the needs of the public." BIS is permitted as a special use within this district. Conditions of the special use permit are outlined by City of Bismarck Code of Ordinances, Chapter 14-03 – Districts:

Uses. Among other things, the special use permit conditions require that BIS not conflict with any existing master plan, that BIS provides adequate vehicle parking, and ensures that, “There is sufficient distance between the end of each usable landing strip and the airport boundary to satisfy the requirements of the Federal Aviation Administration or any other appropriate authority.” BIS can use avigation easements to satisfy this condition, as they have within the Runway 13 end RPZ. Development alternatives that are recommended in Chapter 4 meet the conditions for use within this district. In addition, an airport specific land use plan has been developed as part of the Bismarck Airport Layout Plan.

5.4 GIS AIRSPACE TOOL

The FAA provides basic guidance regarding airspace in the vicinity of an airport that should be protected from tall buildings, structures, and objects. This guidance is described in Federal Aviation Regulations (FAR) Part 77, “Safe, Efficient Use, and Preservation of the Navigable Airspace.” While the most critical locations are beneath the airport and approach surfaces, the siting of tall facilities, such as multi-story structures, power lines, telecommunication towers, wind turbines, and meteorological towers, should be carefully considered whenever they are near an airport. Areas beneath aircraft traffic patterns, adjacent to a runway, off the runway ends, and even far away from an airport, can be hazardous sites due to the potential obstructions of tall structures.

Airport zoning regulations restricting the height of structures and objects of natural growth in the vicinity of BIS were established by City of Bismarck Code of Ordinances, “Chapter 10-09: Airport Zoning Regulations.” An Airport Zoning Map dated March 5, 1979, is referenced in the current zoning code title 14 10-09-03 but is not readily available to the public. A Geographic Information Systems (GIS) tool for airspace zoning was developed as part of this master plan to assist in the required protection of the airspace while allowing the public to understand the buildable height and allowable land uses within land covered

by the Airport Zoning Ordinance. The tool will help BIS apply zoning regulations consistently to all development impacted by the height restrictions.

Airport Zoning GIS data layers were provided to the City of Bismarck including FAR Part 77 surfaces and areas covered by FAA Form 7460, which requires notice to the FAA of proposed construction or alteration of structures that exceed certain height limits. The layers transferred to the city also included the surface area of the 10,000-foot separation buffer for wildlife attractants around BIS. This information was used to create a map tool that the public has access to. This tool enables users to click on the map and immediately see information about Airport zoning height limits, FAA Form 7460 qualification, and the wildlife attractant buffer. An internal version of this tool will allow BIS and City staff to click areas on the map to access Airport zoning height limits, City parcel information, ground elevation contours, and links to the relevant ordinance.

Not only does the tool help users to visualize zoning for existing and potential development, it can provide guidance for the City to update height limit zoning during the planning period. Recommendations from the development of this tool are to consider referencing FAR Part 77 and basing the Bismarck Airport Zoning Ordinance on an updated zoning map that can be produced with the elevation contours delivered in GIS format to allow for future modifications. Neighboring jurisdictions that are included in the Bismarck Airport 14 CFR Part 77 surfaces should protect this airspace and can do so by incorporating zoning by reference. **Appendix C** contains more information about the Airspace tool, and examples of incorporation of an airport height limit zoning ordinance by reference.

5.5 HISTORICAL AND ARCHEOLOGICAL

Historical, architectural, archeological, and cultural resources include a variety of sites, properties, and facilities related to activities as well as societal and cultural institutions. Such resources express past and present elements of human culture and are important to the community. Section 106 of the National Historic Preservation Act is the principal statute concerning historical, architectural, archeological, and cultural resources. Section 106 requires that, prior to undertaking any action (a project, activity, or program), a federal agency consider that action's potential impacts to these resources, specifically those resources included in, or eligible for inclusion in, the National Register of Historic Places.

Review of the National Register of Historic Places found no historic properties or sites within 1 mile of BIS. The closest listed site, Yegen House and Pioneer Grocery, is 1.45 miles away. According to the State Historical Society of North Dakota, there are no state-listed historical sites within 1 mile of BIS. Coordination with the State Historical Society was initiated under this task; to date, no additional information has been provided by the Society regarding resources of historical importance at or near BIS. Locally, the City of Bismarck Historical District and Cathedral Area are approximately 1.5 miles northwest of the Airport in the city core.

A previous EA for the GA apron expansion prepared for BIS was approved by the FAA in 2015. This document included information about five airport buildings in the GA apron area. This EA cited a Class III Architectural Survey that was completed in April 2011. One building (Hangar 5) was found to be eligible for nomination to the National Register of Historic Places. This building will be removed as part of the preexisting north GA development area expansion plan. The Finding of No Significant Impact issued by the FAA for the EA includes recommendations for mitigation: "The preferred mitigation method is to record photographic documentation of Hangar 5 at its current location, find a suitable new owner for Hangar 5, relocate it to another location on the Airport, and

convert it to an aerospace museum." However, the document also notes that, "if a suitable owner is not identified or is not able to remove Hangar 5 within two years of the date of the execution of the MOA [Memorandum of Agreement], BIS shall be allowed to dismantle and dispose of Hangar 5." The MOA was executed in February 2015. BIS advertised for the removal of Hangar 5 for a period of two years; however, no acceptable proposals having adequate financial backing were received. Having met the terms of the MOA, the Airport will now proceed in the removal Hangar 5.

Previous assessments of historic, architectural, archeological and cultural resources were also accounted for in the *Bismarck Airport Environmental Assessment to Minimize Hazardous Wildlife Attractants on Airport Property Feb 2012, Reevaluation Approved April 2017*. Records of prior archeological investigations were consulted at this time, and no significant sites were discovered.

The adverse impacts to historical resources discussed above are associated with a pre-existing development plan. It does not appear that historical, architectural, archeological, or cultural resources will be impacted further by future development proposed by this Master Plan. As part of NEPA-level assessments for individual projects, additional architectural or archeological studies may be necessary, and further consultation with the State Historic Preservation Office and Tribal Historic Preservation Office will be required to identify potential impacts, if any, that could result from each proposed project.

5.6 WATER QUALITY

Water resources, such as surface waters and groundwater, are important to the ecosystem and the human environment. Actions that impact water quality can have environmental and legal consequences. The Clean Water Act (CWA) mandates development of comprehensive solutions to prevent, reduce, or remove pollution in U.S. waters. Among several other regulations that protect water quality are those that offer

special protection to drinking water supplies and those that require establishment of spill response plans. In addition, airport sponsors may need to consult with the U.S. Fish and Wildlife Service (USFWS) when bodies of water are controlled, altered, diverted, or drained.

Several activities, such as construction, aircraft and pavement deicing, and fuel or hydraulic spills, if runoff is not properly controlled, can impact the quality of drainage waterways. Careful planning and analysis may be required to determine whether water quality impacts could occur as a result of future airport development.

5.6.1 Stormwater

Stormwater is surface water from precipitation such as rain or snow. When surface water from industrial sites, such as an airport, contains pollutants, environmental impacts can occur. Impacts can also occur due to a high volume of stormwater runoff from impervious surfaces. For this reason, BIS carefully manages stormwater and drainage.

BIS has a general North Dakota permit for industrial stormwater discharge administered by the North Dakota Department of Health, which also establishes testing protocols. FAA regulations concerning culvert design and stormwater ponds do not permit standing water on airport property for periods longer than 48 hours in new or reconstructed detention areas. Additional details on standards for drainage design can be found in AC 150/5320-5D: Airport Drainage Design and AC 150/5200-33C: *Hazardous Wildlife Attractants On or Near Airports*.

The Airport conducted a drainage analysis in 2018. During this analysis, BIS updated the stormwater management plan and expanded upon conclusions from several previous stormwater reports and wetland delineations conducted on and near BIS. Several areas

of the existing stormwater drainage system require maintenance or improvements because they experience drainage backups and ponding that can attract wildlife hazards.

A common pollutant that affects stormwater in airport settings is deicing fluid containing propylene glycol. At BIS, deicing fluid is currently treated by discharging through several grassy swales, where bacteria and ultraviolet radiation break down the propylene glycol before it reaches Apple Creek. The 2018 Drainage Analysis concluded that some deicing fluid at BIS was not being captured and made recommendations to upgrade drainage, including regrading surface drainage and installing storm sewer. More information about the existing stormwater system and draft recommendations can be found in the *2018 Bismarck Airport Drainage Analysis Central Airport Watershed* report.

To achieve NEPA approval, FAA may require further analysis of any added impervious surfaces that would increase the amount of stormwater runoff at BIS; however, the planned drainage improvements are anticipated to improve the existing conditions and decrease the amount of pooling water and back-up from storm drains during runoff events.

5.6.2 Surface Water

Surface waters include lakes, ponds, rivers, streams, creeks, and wetlands. The collected water comes from precipitation that does not infiltrate the soil and instead flows across the land. Surface waters can be hydrologically connected (linked) to groundwater. There are two lakes/ponds located near BIS: Cottonwood Park Pond and Cottonwood Lake. Cottonwood Park Pond in Cottonwood Park is approximately 0.85 miles west of BIS, and Cottonwood Lake is in a residential area northwest of Cottonwood Park approximately 1 mile west of BIS.

Apple Creek runs north-south just east of BIS. A section of this creek flows onto Airport property southeast of Runway 31. In addition, small tributaries that appear to be associated with Apple Creek are located within the northeastern segment of Airport property near Airway Avenue.

Hay Creek is located within the vicinity of BIS (northeast near East Bismarck Expressway 810 and Yegan Road). The North Dakota Department of Health Division of Water Quality is responsible for monitoring water bodies in the state and determining if a water body is impaired. A body of water is considered impaired if it fails to meet one or more water quality standards. Historically, the North Dakota Department of Health Division of Water Quality designated segments of Hay Creek near its confluence with Apple Creek as impaired waters by due to sedimentation/siltation (reference ND-10130103-007-S_00). Per the North Dakota 2014 Integrated Section 305(b) Water Quality Assessment Report and Section 303(d) List of Waters Needing Total Maximum Daily Loads, an assessment conducted in 2013 found that Hay Creek's sediment load met the criteria for a stable site and assumed that sediment is no longer impairing aquatic life. Future projects at BIS should be managed to avoid or minimize impacts to this and other surface water resources in the area.

5.6.3 Wetlands

Wetlands are areas that support specific vegetation due to inundation or saturation by ground water. Sometimes these are called swamps, marshes, or bogs. Wetlands provide benefits to the natural and human environments that include habitat, water filtration, water storage, and recreation. There are several statues, regulations, orders, and other requirements related to wetlands. The CWA regulates the discharge of pollutants into waters of the United States (including wetlands) and establishes a program to regulate discharge of fill material into such waters. The CWA also requires projects not to violate water quality standards.

A water of the United States is considered a jurisdictional surface water or wetland under the CWA; however, not all surface waters are under the jurisdiction of the CWA. The United States Army Corps of Engineers (USACE) determines this case by case. Wetlands are protected under Executive Order 11990, Protection of Wetlands. According to the 2017 Stormwater Analysis, the USACE has designated one of the wetlands near the runway intersection as jurisdictional.

This Master Plan did not include a wetland delineation or a field check of available wetland maps. However, detailed information about wetlands at BIS can be found in the *2017 Bismarck Airport Stormwater Analysis Central Airport Watershed* report. This report discusses a series of wetland delineations conducted from 2008 to 2017. The delineated areas include several wetlands near the runway intersection and in the northwest and northeast portions of BIS property.

A review of US Fish and Wildlife Service's National Wetlands Inventory (NWI) mapping tool (Wetland Mapper), also shows Freshwater Emergent wetlands located near the runway intersection and within the eastern and central portions of Airport property. Through correspondence with BIS staff and review of the *2017 Bismarck Airport Stormwater Analysis Central Watershed* report, wetlands located on the northwest and northeastern portions of airport property have previously been filled in under an approved federal permit. As a result, the current wetlands mapping available online for BIS does not accurately reflect the presence of wetlands in these areas. In fact, most Airport property has been graded, developed and is maintained in a mowed or planted condition. Outside airport property, there appear to be a few wetlands within the general vicinity of BIS, including:

- Freshwater Emergent Wetlands to the east and north

- Freshwater Forested/Shrub Areas in all directions, including Cottonwood Park Pond to the west
- Freshwater Ponds to the south
- A riverine to the northeast
- "Other" wetlands to the northwest and southeast.

Development projects are required to avoid wetlands to the greatest extent possible unless practicable alternatives do not exist. In general, actions that are considered impacts to wetlands include:

- Building structures in a designated wetland
- Dredging, filling, draining, channelizing, creating a dike, or impounding a wetland
- Causing disturbance of a water table
- Indirect impacts affecting areas upstream or downstream from the development site.

Further assessment of potential wetland resources on Airport property may be required for NEPA-level documentation for the individual development projects proposed under this Master Plan. The *2017 Bismarck Airport Stormwater Analysis Central Airport Watershed* includes recommendations to remove some wetlands from Airport property that have undergone review in the Bismarck Airport Environmental Assessment to Minimize Hazardous Wildlife Attractants on Airport Property Feb 2012, Reevaluation Approved April 2017. Past projects have successfully removed wetlands from the airfield. These projects have resulted in noticeable differences in the number of migratory birds within the vicinity of the Airport. Administration will continue to pursue opportunities to appropriately reduce wetlands that may attract or harbor wildlife in the future. Runways 3 and 31 have future projects identified to further reduce wildlife attractants.

5.6.4 Floodplains

See **Section 5.2.6** above.

5.6.5 Groundwater

Groundwater, or subsurface water, can be an important source of water for households, businesses, industries, and agriculture. Developments proposed under this Master Plan are not anticipated to impact groundwater resources; however, further investigation may be needed to determine any potential impacts to groundwater, aquifers, or other similar water resources in proximity of BIS.

Wild and Scenic Rivers

The Nationwide Rivers Inventory (NRI) is a list that the United States Department of the Interior National Park Service (NPS) maintains. The list identifies river segments that possess remarkable natural or cultural values and are of more than local or regional importance. All federal agencies are required to seek to avoid or mitigate impacts to NRI segments. While a section of the Missouri River in Burleigh County is listed on the NRI as one of few remaining free-flowing segments of the Missouri River, and considered important due to wildlife habitat and historic and archeological sites, this segment is approximately ten miles northwest of BIS.

The National Wild and Scenic Rivers System preserves rivers with outstanding natural, cultural, and recreational values. The system is administered by the Bureau of Land Management, NPS, USFWS, and the United States Forest Service. Rivers designated as American Heritage Rivers list are also protected. A review of the American Heritage Rivers list and USFWS Wild and Scenic Rivers System map found that no rivers in North Dakota are protected under these programs.

5.7 FISH, WILDLIFE, AND PLANTS

Biological resources include plants (vegetation), animals (wildlife), and the habitats where they occur. Habitats are the resources and conditions that support the continuous existence of plants or animals in any particular area. Together, biological resources form

dynamic ecosystems that respond over time to changes in the environment, whether natural or human-induced. Biological resources provide aesthetic, recreational, and socioeconomic values to society and are valuable in their own right. Accordingly, federal and state laws and statutes exist to protect certain species and habitats of special importance.

The Endangered Species Act (ESA) is the primary statute protecting wildlife, plants, and their habitats. The ESA requires federal agencies to conserve threatened and endangered species and avoid adverse impacts to designated critical habitats. When a development could affect listed species, the Airport sponsor must consult with the USFWS to assess potential impacts on plant and animal species. They must also consult with state wildlife agencies with jurisdiction over the affected resources. The level of analysis depends on whether the proposed development occurs on previously disturbed lands or undisturbed wildlife habitats. Projects located on developed land such as Airport property generally require minimal analysis.

According to the IPaC Report, found in **Appendix G** there are four federally listed endangered species and three federally listed threatened species in Burleigh County. The State of North Dakota does not maintain a state endangered and threatened species list, but instead relies on the Federal lists regarding the status of biological resources.

These are the listed species found in Burleigh County:

- Birds
  - Least Tern – Endangered
  - Whooping Crane – Endangered
  - Piping Plover – Threatened
  - Red Knot – Threatened
- Fish

  - Pallid Sturgeon – Endangered
- Mammals
  - Gray Wolf – Endangered
  - Northern Long-eared Bat – Threatened

Of these listed species, only the piping plover has final designated critical habitat in North Dakota, and this habitat is not found on or around BIS. The other species are unlikely to be found on the Airport because there is not suitable wildlife habitat.

More information is available in the *2015 Bismarck Airport Wildlife Hazard Management Plan* and *2013-2014 Wildlife Hazard Assessment of the Bismarck Airport* developed by the Airport.

Review of detailed information about these species and their habitats was not completed under this Master Plan project. Further research and consultation with the USFWS regarding federally listed species will likely be required during NEPA-level assessments conducted for individual projects.

The recommended projects proposed under this Master Plan do not involve modification of a natural stream, body of water, or other water resources; therefore, the projects are unlikely to impact resources protected under the Fish and Wildlife Coordination Act. The projects proposed under this Master Plan are not anticipated to directly or indirectly affect fish species, habitat, or public access. Also, BIS does not appear to include water resources that may be considered fish habitat. Therefore, impacts to resources protected under the Magnuson-Stevens Act are not anticipated from the proposed development projects.

5.8 HAZARDOUS MATERIALS

Federal, state, and local laws regulate the handling and disposal of hazardous materials, chemicals, substances, and wastes. Applicable federal statutes include the Resource Conservation and Recovery Act and the Comprehensive Environmental Response, Compensation, and Liability Act as amended by the Superfund Amendments and Reauthorization Act of 1986 and the Community Environmental Response Facilitation Act of 1992.

Information from the United States Environmental Protection Agency's (USEPA's) NEPAssist and Cleanups in My Community databases indicates that there are several facilities subject to environmental regulation within a 1-mile radius of BIS:

- Four facilities that discharge to a water point
- Five water monitoring stations (four along Apple Creek and one on Hay Creek)
- Four companies registered under the Toxic Release Inventory program
- Five facilities regulated for air emissions
- Eight facilities regulated under the National Pollutant Discharge Elimination System (NPDES) program
- Forty-eight facilities that generate hazardous waste and are regulated under the Resource Conservation and Recovery Act.

These sites are shown in **Figure 5-5**. Activities at BIS may also be potential sources of hazardous materials and wastes, for example aircraft fueling and maintenance.

There are two fuel farms at BIS; one owned by Executive Air Taxi Corporation and the other by Bismarck Aero Center (the Airport's two fixed-based operators). Combined these facilities have nine tanks and store 1,000 gallons of diesel fuel; 32,000 gallons of 100 low lead (LL) fuel; and 82,000 gallons of Jet A fuel. Based on information that BIS provided, these facilities have secondary containment features, approved by the USEPA, to collect

fuel in the event of an accidental release. In addition to the fuel farms, the fixed-base operator operates fuel trucks with a total capacity of 1,750 gallons of 100LL and 13,000 gallons of Jet A. The Airport's fixed-base operators also provide aircraft maintenance.

BIS also has a fleet of equipment that contain potential sources of hazardous materials including snow removal equipment, aircraft rescue and firefighting equipment, mowers and trucks. Each of these equipment types require regular maintenance. Fuel for these vehicles is provided by two diesel fuel tanks consisting of one 1,500 gallon and one 1,000-gallon tank. In addition, BIS has one 1,000-gallon tank containing unleaded fuel. All three of these fuel tanks are located adjacent to the existing BIS maintenance facility. BIS has one 12,000-gallon tank containing unleaded fuel used by the rental car companies. This tank is located near the car rental storage lot. BIS meets current federal and state requirements for operating and servicing equipment to minimize the potential risk of exposure to hazardous materials.

Proximity alone to industrial facilities that are subject to environmental regulation (including those that generate hazardous waste) is not a sufficient indicator of potential hazardous waste impacts or other environmental concerns. Such facilities are heavily regulated and maintained to prevent potential issues. Per FAA Advisory Circular 1050.4A BIS maintains an active spill prevention and response plan to limit and mitigate the impacts of a rare hazardous release. Further assessment of potential hazardous material impacts for example, Phase I or Phase II Environmental Site Assessments, may be required under the preparation of NEPA-level documentation for individual development projects proposed under this Master Plan.

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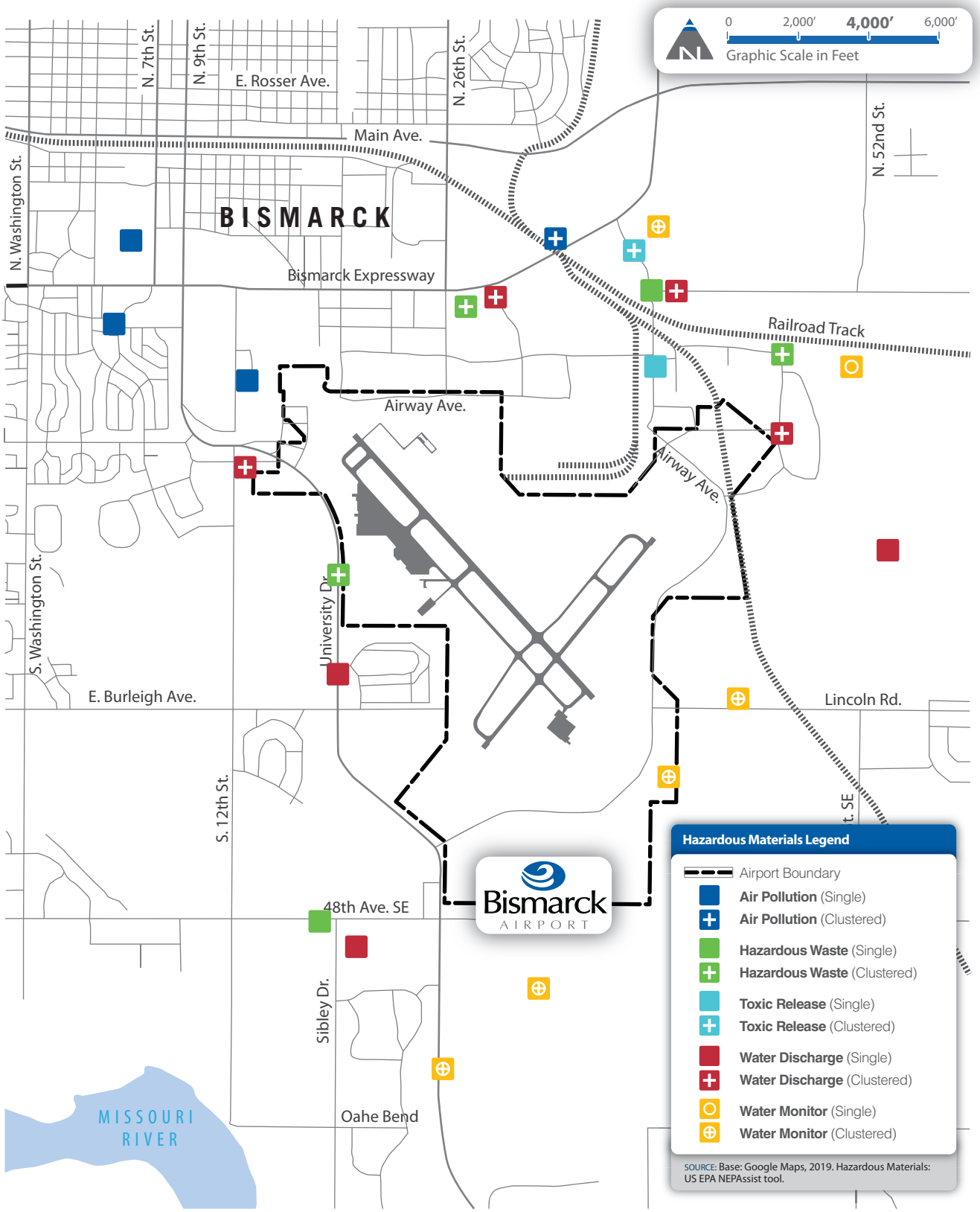

Figure 5-5 **Hazardous Materials**

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5.9 SOLID WASTE AND RECYCLING

Solid waste is defined as any material resulting from industrial, commercial, mining, agricultural, or community activities. Solid waste generated from airport-related construction projects and operation may result in negative environmental effects and, without careful planning and management, may present a danger to human health and the environment. When proposed development could cause or change a solid waste stream, an environmental review should take place to discuss the amount of waste that will be generated by construction and operations and how the waste will be handled and disposed of properly to minimize environmental impacts.

Construction, renovation, or demolition projects produce waste that must be properly disposed. Debris such as dirt, concrete, and asphalt can increase the volume of waste generated, impacting processing and disposal facilities. Waste generated from daily operational activities such as passenger terminal operations, air cargo processing facilities, parking facilities, and rental car operations can also impact waste processing and disposal facilities. NEPA documentation for proposed projects should assess landfill, waste processing, and disposal facilities to determine whether they have the needed capacity to absorb the waste stream.

The FAA Modernization and Reform Act of 2012 updated the definition of airport planning to include waste and recycling that required airports completing a Master Plan to consider issues related to waste and recycling. To meet this requirement, an Airport Recycling, Reuse, and Waste Reduction Plan was developed for BIS and is included in Appendix D of this Master Plan report. This plan evaluated BIS's existing waste and recycling program and provided recommendations for increasing landfill diversion through waste reduction, reuse, and recycling.

A consultant conducted a facility walk-through and informal interviews with Airport staff to develop a baseline and to identify areas of opportunity to divert waste from the landfill. The consultant developed recommendations appropriate for the Airport's waste stream based on the baseline information. Highlights of these recommendations include:

- Establish goals and objectives.
- Track progress and report regularly.
- Promote emptying of water bottles before security and refilling after security.
- Collect and donate food, beverages, and toiletries.
- Encourage reuse of items and materials.
- Continue paper, plastic, plastic bottle, aluminum can, cardboard, and glass recycling and expand to other areas, including deplaned waste.
- Improve education and outreach for passengers, employees, tenants, and contractors.
- Supplement, right size, collocate, and standardize recycling stations and garbage cans.
- Expand and improve signage, specifically at the security checkpoint.
- Update contracts/leases and establish purchasing policy.
- Maintain and improve recycling program according to Plan-Do-Check-Act (PDCA) cycle- a four-step planning process designed to achieve continuous improvements in quality. Information available at: https://asq.org/quality-resources/pdca-cycle.

This range of recommendations will allow BIS the flexibility to implement those that are compatible with changing conditions and available resources, while providing the opportunity to increase landfill diversion over time through a phased, comprehensive program. Please see the BIS recycling plan for more detailed information in **Appendix D**.

5.10 WETLANDS

See **Section 5.6.3** above.

5.11 OTHER ENVIRONMENTAL CONSIDERATIONS

5.11.1 Air Quality

An air quality analysis is the measure of the condition of the air in terms of pollutant concentrations. Air quality is regulated out of concern for human health (especially the health of children, the elderly, and those with certain health conditions). Poor air quality can also affect crops and vegetation as well as buildings and other facilities. Air quality is regulated by the USEPA under the Clean Air Act, which includes standards for six pollutants. The USEPA regulates these pollutants to permissible levels via standards called National Ambient Air Quality Standards (NAAQS).

Areas that have concentrations of the criteria pollutants below the NAAQS are designated as “attainment areas.” Areas with concentrations of these pollutants above the NAAQS are designated as “nonattainment areas.” Nonattainment areas must implement plans to lower pollutant levels below the standards. In addition, aviation-related federal actions planned for nonattainment areas must conform to such plans (also known as “General Conformity”).

According to the USEPA’s Current Non-Attainment Counties for All Criteria Pollutants list, all the counties in North Dakota are currently in an attainment for NAAQS pollutants; no counties are listed as being in non-attainment.

Construction activities, such as those required under proposed future projects, may temporarily impact air quality; such impacts should be evaluated project by project to determine whether they would be significant.

5.11.2 Climate

Greenhouse gases are those that trap heat in the earth's atmosphere. Both naturally occurring and anthropogenic (man-made) greenhouse gases include water vapor (H2O), carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and ozone (O3).
Research has shown a direct link between fuel combustion and greenhouse gas emissions. Therefore, sources that require fuel or power at an airport are the primary sources that generate greenhouse gases. Aircraft jet engines, like many other vehicle engines, produce CO2, water vapor, nitrogen oxides, carbon monoxide, oxides of sulfur, unburned or partially combusted hydrocarbons (also known as volatile organic compounds [VOCs]), particulates, and other trace compounds.

Airport development has the potential to both affect climate change and to be affected by it. Changes in resource categories such as air quality, natural resources, and energy supply can potentially contribute to climate change by increasing the amount of greenhouse gases emitted. Conversely, some airport projects may be impacted by the potential effects of climate change.

Based on FAA data, activity at BIS as compared to total aviation activity throughout the United States represents less than 1 percent of U.S. aviation activity. Therefore, assuming that greenhouse gases occur in proportion to the level of activity, greenhouse gas emissions associated with existing and future aviation activity at BIS would be expected to represent less than 0.03 percent of U.S.-based greenhouse gases. Therefore, emissions of greenhouse gases as a result of the proposed projects are not expected to be significant.

5.11.3 Coastal Resources

Coastal resources are those within coastal waters and shorelands such as islands, salt marshes, estuaries, beaches, and dunes as well as their wildlife and habitats. Coastal

resources include those along the oceans as well as the Great Lakes. These resources are protected under the Coastal Barrier Resources Act and the Coastal Zone Management Act as well as several other statues.

North Dakota is located in the upper Midwestern region of the United States, is bordered by three states as well as two Canadian provinces, and does not have any coastal borders. Therefore, no resources in North Dakota or the Bismarck area are protected under the Coastal Barrier Resource Act or the Coastal Zone Management Act.

5.11.4 Natural Resources and Energy Supply

Airport activities, including construction, operation, and maintenance have the potential to modify a facility's consumption of natural resources (such as water or construction materials) and use of energy supplies (electricity, natural gas, or fuel for aircraft and ground vehicles). Natural resource and energy supply impacts are those that could increase the amount of energy required to operate aircraft, Airport-related service vehicles, terminal lighting, and other uses such as heating and air-conditioning. Except for electricity necessary to operate airfield lighting, navigational aids (NAVAIDs), and other energy dependent components, energy requirements for an airport largely depend upon aviation activity levels.

The FAA defines two types of energy use that should be considered when determining the potential natural resource and energy supply impacts of a proposed project:

- Natural resource and energy supply related to major changes in stationary facilities such as airfield lighting, building heating and cooling needs that may exceed local supply or capacities
- Natural resource and energy supply related to major changes in the movement of aircraft and ground vehicles to the extent that demand exceeds available energy supply.

Aviation activity levels at BIS are forecasted to increase, which may result in an increase in the energy required for aircraft operations at the facility; however, increasing activity levels are not anticipated to create a significant demand for energy or natural resources. Installation of light-emitting diode (LED) airfield lighting that requires less energy than incandescent lighting may also decrease airfield energy consumption.

Given that the availability of natural resources and energy to the Airport as a result of its location near a major metropolitan area and that existing demand for natural resources and energy are within existing capacity, adverse impacts resulting from the proposed projects are not anticipated on energy supplies or natural resources. It is anticipated that existing supplies of natural resources and energy will be adequate to accommodate proposed improvements at BIS and changes to aircraft and other vehicle movement.

5.11.5 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

Major airport development projects can impact the socioeconomic conditions of the surrounding community. Such projects have the potential to impact neighboring populations, including children, and may do so disproportionately to the overall area population.

Environmental justice requires the fair treatment of people of all races, cultures, and income levels, and no group of people should shoulder a disproportionate share of impacts of a given project. Environmental justice is defined as the right to a safe, healthy, productive, and sustainable environment for all, where environment includes the ecological, physical, social, political, aesthetic, and economic environment. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations is intended to identify, address, and avoid

disproportionately high and adverse human or environmental impacts on specific populations.

FAA Order 1050.1F requires evaluation of potential environmental health and safety risks that could disproportionately affect children. These could include products or substances a child is likely to encounter or ingest, such as air, food, drinking water, recreational waters, soil, or products they might use or to which they might be exposed.

Information regarding socioeconomic characteristics of the area within a 1-mile radius of BIS was obtained from the US Census Bureau. According to this information, an estimated 7,440 people live within 1 mile of BIS and about 11 percent of those are estimated to represent a minority population (based on trends from the greater Bismarck and Burleigh County areas). The EPA's Environmental Justice Screening tool includes a demographic index that combines minority and low-income population characteristics in census block groups. The concentration of residents who are within an environmental justice population category near BIS are shown in **Figure 5-6**.

The proposed projects including in the near- to mid-term planning period would occur on existing Airport property; therefore, there would be no minority or low-income populations within the proposed project areas. While such populations may exist near BIS, the proposed projects are not anticipated to cause impacts to residents, businesses, or other environmental justice communities in the area.

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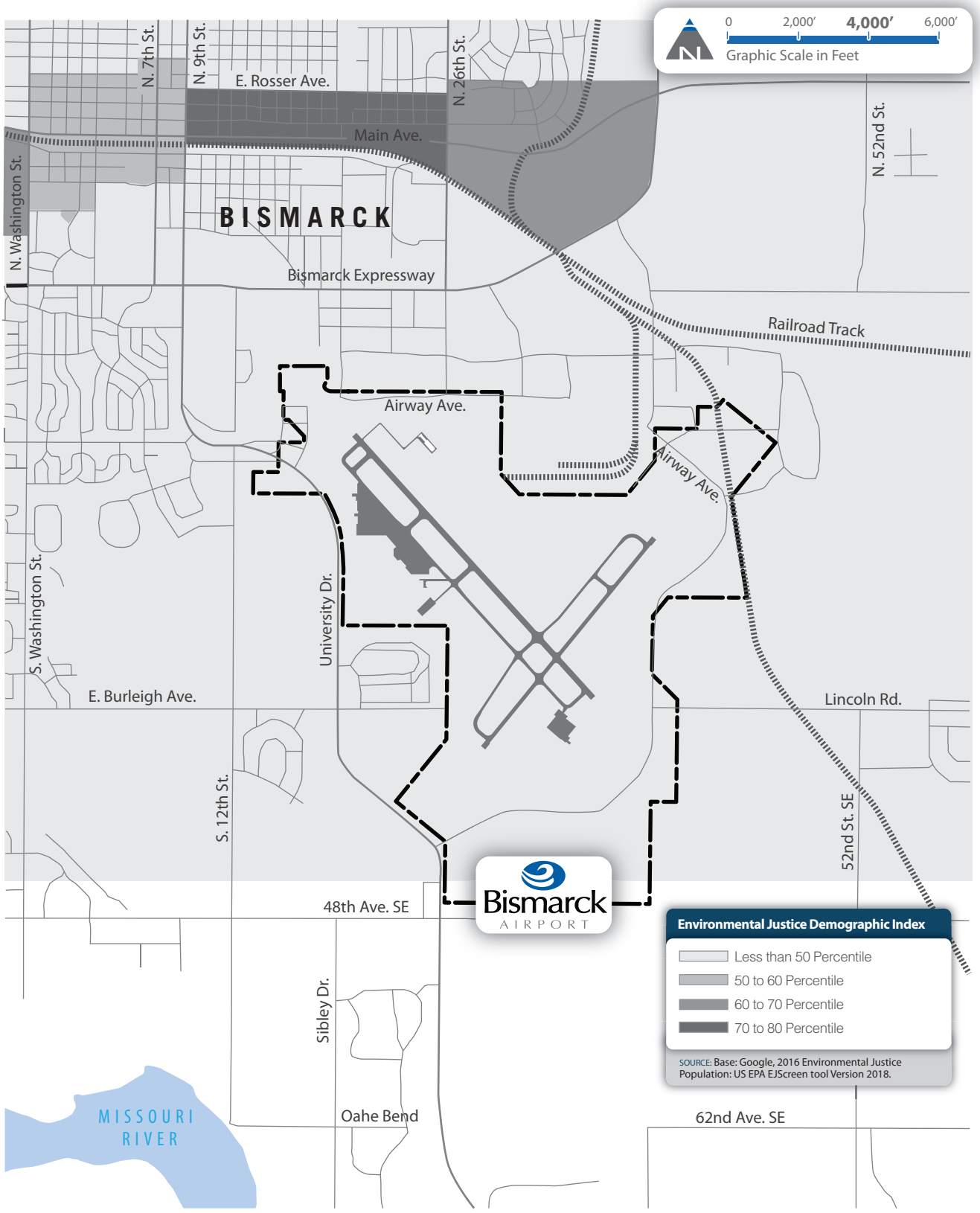

Figure 5-6 **Environmental Justice Populations**

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5.11.6 Visual Effects

Airport lighting such as runway lights, taxiway lights, NAVAIDs, parking lot lights, and terminal/hangar building lights can produce light emissions that could potentially contrast with the visual character of an area. When a project is proposed that would introduce new or relocated airport lighting facilities, a visual effects analysis may be needed to determine the impact to residential or other sensitive areas as well as glare that could affect pilots and air traffic controllers. A complete visual effects analysis can be conducted as a part of the NEPA process prior to the construction of a project. At the time of this environmental overview, an initial review of potential visual effects was conducted.

Overall, the proposed developments are not anticipated to result in visual effects that could impact local residences and other light sensitive areas. Reconfiguration of the airfield may involve relocation or replacement of existing fixtures; however, the total number of fixtures and intensity of airfield lighting is not anticipated to change under the proposed projects. Construction of new structures that could introduce new lighting, such as hangars, may incorporate shielding elements, where appropriate, to reduce visual effects for areas surrounding the immediate vicinity of BIS. Each project may require review for visual effects during the environmental review process to determine if shielding measures are needed.

5.12 CONSTRUCTION IMPACTS

Construction results in temporary environmental effects. The primary resource categories that are affected by construction activities are air quality, natural resources and energy supply, stormwater, and solid waste.

Air quality may be temporarily impacted by construction vehicles and equipment that will increase emissions at BIS during implementation of proposed projects. The increase in emissions will be accounted for project by project in environmental review documents.

Construction projects temporarily change an airport's demand on local energy and natural resource supplies. This has short-term impacts on fuel used by construction vehicles, fuel used by aircraft or other vehicles that must take a detour around construction, and the use of construction materials required for the proposed action. Consumption of energy and natural resources during the construction phase of the proposed projects will consist mainly of construction materials and fuel used by construction machinery. This consumption will be evaluated project by project but is not likely to exceed locally available supplies.

Construction activities can impact stormwater and drainage. Disturbing soil can lead to increased erosion and sediment in runoff, while heavy equipment can compact soil making it more difficult for water to infiltrate. These impacts will be evaluated on a project by project basis, and best management practices should be employed in order to minimize negative impacts.

The proposed projects will produce construction debris such as dirt, concrete, and asphalt. Construction materials and other solid waste should be disposed of at a landfill capable of handling disposal.

5.13 CONCLUSION

This overview identified potential environmental issues that will need to be addressed as BIS moves forward with implementation of its plan. The level of NEPA documentation, whether an Environmental Impact Statement, Environmental Assessment, or Categorical Exclusion, will depend on the needs as defined in the detailed project planning process. The NEPA process will identify required permits and mitigation activities.

Finally, the Consultant reviewed the existing City of Bismarck Zoning Ordinance, Title 10 and Title 14, as it pertains to zoning classifications and the use of an airport noise overlay district to align the current zoning classifications and airport noise overlay district with the airspace mapping tool developed as part of the BIS airport master plan. As shown in **Appendix C**, a list of text revisions for both Title 10 and 14 depict the recommended changes to the City's current zoning ordinance. Consideration and coordination with agencies prior to future development activities will allow BIS to continue to be a good steward of the environment and protect surrounding airspace vital to BIS.

6.0 FINANCIAL IMPLEMENTATION ANALYSIS

The primary objective of the Financial Implementation Analysis for the Bismarck Airport (BIS) Master Plan is to evaluate the Airport's capability to fund the projects in the current Airport Capital Improvement Plan (ACIP), to fund projects recommended in the preferred airport alternative, and to finance Airport operations during the same period. The Financial Implementation Plan is organized in three phases of development:

- Phase I, a three-year Short-Term period (2018-2020)
- Phase II, a five-year Mid-Term period (2021-2025)
- Phase III, a ten-year Long-Term period (2026-2035).

The analysis includes development of a detailed Financial Implementation Plan. Objectives for developing the Financial Implementation Plan include presenting the results of the implementation evaluation and providing practical guidelines for matching an appropriate amount and timing of financial sources with the planned use of funds.

6.1 OVERALL APPROACH

The overall approach for the Financial Implementation Analysis included these steps:

- Gather and review key Airport documents related to historical financial results, ACIPs, operating budgets, regulatory requirements, City policies, airline agreements and other operating agreements with Airport users
- Interview key Airport officials to understand the existing operating and financial environment, relationships with the airlines, and overall management philosophy
- Review the Aviation Activity Forecast developed in this Master Plan (Chapter Two)
- Review the Airport Capital Improvement Program project cost estimates and development schedules anticipated for the planning period and project the overall financial requirements for the program
- Determine and analyze the sources and timing of capital funds available to meet the financial requirements for operating the Airport and financing the Airport Capital Improvement Program

- Analyze historical operations and maintenance expenses, develop operations and maintenance expense growth assumptions, review assumptions with Airport management, and project future operations and maintenance expenses for the planning period
- Analyze historical revenue sources, develop revenue growth assumptions, reviewing assumptions with Airport management, and project future airline and non-airline revenues for the planning period
- Document the results of the review in a Financial Analysis Summary that evaluates the financial reasonableness of the Airport Capital Improvement Program.

6.2 CAPITAL FUNDING SOURCES

In the past, the Airport has used a combination of Federal Aviation Administration (FAA) Airport Improvement Program (AIP) entitlement and discretionary grants, North Dakota Aeronautics Commission grants, Passenger Facility Charges (PFCs), City Capital Contributions and cash reserves/net operating revenues to fund capital improvements. These funding sources, as well as additional sources of capital funding, will continue to be important to finance the Airport's Master Plan ACIP during the planning period.

6.2.1 Airport Improvement Grants

The Airport receives grants from the FAA to finance the eligible costs of certain capital improvements. The FAA allocates these federal grants to commercial passenger service airports through the AIP. AIP grants include passenger entitlement grants, which are allocated among airports by a formula that is based on passenger enplanements and discretionary grants which are awarded in accordance with FAA guidelines. After several years of continuing budget resolutions and other short-term legislative measures implemented by Congress, the FAA Reauthorization Act of 2018 was enacted on October 5, 2018. The Act authorized funding for the AIP through September 30, 2023.

Under current AIP authorization legislation, eligible projects are funded on an up to 90 percent AIP grant/10 percent local match basis for small and non-hub airports. Under this authorization, projections indicate the Airport is projected to receive current entitlements of about $2.2 million in 2018 and future annual grants which are projected to grow to $2.9 million by 2035 - the end of the planning period. Non-hub airports (those with annual enplanements between 10,000 passengers and approximately 428,000 passengers) can accumulate and carryover up to three years of unspent entitlements plus the current year before the awards are revoked. In 2018, the Airport had no unspent entitlements to carry over for use in 2018. The implementation analysis assumes the application of annual AIP passenger entitlement funds will result in the following funding levels for each phase:

- Phase I: $6.7 million
- Phase II: $11.8 million
- Phase III: $27.2 million

To approve and award AIP discretionary grants, the FAA ranks eligible projects based on a project's priority and importance to the national air transportation system. Every year from 2014 through 2017, BIS received discretionary funding to support its Runway 13-31 Rehabilitation project. It is reasonable to assume that the Airport will receive additional discretionary funding during the planning period for higher priority, eligible projects, such as runway and taxiway projects, drainage improvements to eliminate wildlife hazards and aircraft rescue and firefighting (ARFF) truck acquisition.

The implementation analysis assumes that $6.7 million of AIP discretionary funds will be required during Phase I for the rehabilitation of Taxiway C North and one of several projects to improve airfield drainage to eliminate wildlife hazards. The implementation analysis also assumes that AIP discretionary grants of about $20.5 million will be available for continued airfield drainage improvements, the rehabilitation of Runway 3-21, the rehabilitation of Taxiway D and the acquisition of a new ARFF truck during the five-

year Phase II period. An additional $9.4 million of AIP discretionary funds are assumed for Phase III for additional airfield drainage improvements. Since the future availability of AIP discretionary grants is not certain until an actual grant is awarded, there is the potential for ACIP projects with discretionary funds indicated as a funding source in the implementation plan to be delayed until such funds become available.

Further, the FY 2018 omnibus appropriations bill included an additional amount of $1 billion for ‘‘Grants-In-Aid for Airports’’ to remain available through September 30, 2020. This “supplemental” $1 billion is funded through the General Fund of the Federal Government, administered by the Office of Management and Budget (OMB), not the Airports & Airways Trust Fund, which is used to fund AIP Entitlement and Discretionary Grants. Congress directed the FAA to give priority for allocating the grants-in-aid funding to non-primary airports, those not located within OMB-determined Metropolitan or Micropolitan areas. Congress also gives priority to projects at small and non-hub airports. BIS was awarded a $9.8 million grant from this supplemental appropriation to fund the final phase of its Runway 13-31 Rehabilitation project.

The Airport continues to work with the FAA to identify projects included in its ACIP that may be candidates for future funding from this additional supplemental appropriation. As the award of such funds remains undetermined, this implementation analysis does not assume the receipt of additional “supplemental” funds. However, if the Airport is awarded funding through this supplemental appropriation, the additional funding is likely to replace the AIP entitlement funds assumed to fund projects so that AIP entitlement funds could be made available to fund other eligible projects in the ACIP.

The implementation analysis further assumes that the current AIP program will continue to be extended through 2035. Therefore, the analysis also assumes future program

authorizations will provide substantially similar funding levels as it currently does and as it has historically provided since the program was established in 1982.

6.2.2 North Dakota Aeronautics Commission Grants

The North Dakota Aeronautics Commission (the Commission) disburses funding annually to public airports across the state for airport improvement projects. These grant funds are derived primarily through aviation fuel taxes, aircraft excise taxes and aircraft registration. The Commission has established a priority rating of airport projects and uses these ratings to assist in awarding state grants.

In the Commission's rating system, FAA AIP projects are given priority in determining state funding. Airport sponsors may apply for state grant funding at 50 percent of the local share of project costs. For BIS, the Commission has historically funded 5 percent of AIP project costs. The implementation analysis assumes the Commission will continue to fund 5 percent of AIP project costs. Additionally, the analysis assumes that for certain higher priority projects for which no AIP funds are available, the Commission will participate in 50 percent of the project costs with the Airport funding the remaining 50 percent. The implementation analysis assumes the following funding levels from the ND Aeronautics Commission:

- Phase I: $1.3 million
- Phase II: $8.8 million
- Phase III: $4.5 million

6.2.3 Passenger Facility Charges

The Aviation Safety and Capacity Expansion Act of 1990 established the authority for commercial service airports to apply to the FAA to impose and use a PFC of up to $3.00 per eligible enplaned passenger as funding for certain eligible projects. With the passage of AIR-21 in June 2000, airports could apply for an increase in the PFC collection amount from $3.00 per eligible enplaned passenger to $4.50. The proceeds from PFCs are

eligible to be used for AIP eligible projects and for certain additional projects. Approved projects must meet one of the following PFC objectives:

- That preserve or enhance capacity, safety or security
- That mitigate the effects of aircraft noise
- That enhance airline competition.

PFCs may also be used to pay debt service on bonds (including principal, interest and issue costs) and other indebtedness incurred to carry out eligible projects. In addition to funding future planned projects, the legislation permits airports to collect PFCs to reimburse the eligible costs of projects that began on or after November 5, 1990.

BIS currently collects PFC revenues through an approved application at the $4.50 collection level. Current collections at the $4.50 collection level are approximately $1.1 million per year. This open application includes PFC collection and use authority for the local funds required for the Airport's multi-year Runway 13-31 Rehabilitation project. It is estimated that PFC collections though the year 2029 in the total amount of approximately $15 million will be used to reimburse the Airport for pre-2018 eligible project costs.

The implementation analysis assumes that the Airport will use approximately $737 thousand in PFC collections in 2018 for the completion of the Runway 13-31 Rehabilitation project. The analysis then assumes that the Airport will submit new PFC applications to fund future projects or to be reimbursed for previously funded eligible project costs. The implementation analysis assumes that PFCs will be used on a pay-as-you-go basis to fund new projects of approximately $9.6 million in Phase III.

The implementation analysis assumes that the Airport will submit PFC applications and amendments, as required, to see that the collection of PFC revenue continues

uninterrupted beyond the authorized expiration date through the end of the planning period in 2035.

6.2.4 Other City Capital Contribution

BIS is municipally owned. The airport is an enterprise fund of the City of Bismarck, North Dakota. The City periodically provides funding to the airport for capital projects from its local capital budget. The City previously provided funding to support construction of the Airport's new passenger terminal building that opened in 2005. The implementation analysis assumes the City will provide approximately $10 million toward future expansion of the passenger terminal building planned during the Phase II planning period.

6.2.5 Private Third Party Funding

Certain on-airport development projects may be funded through private third-party funding. This is frequently the case for general aviation hangar development where a third party will assume the capital development costs of a hangar, and in exchange, the Airport receives rent through a ground lease. The implementation analysis assumes private third-party funding in Phase III of the planning period of approximately $4.5 million for the development of the corporate hangar area and fuel farm expansion. If private third-party funding does not materialize in time, the associated projects may have to be modified, delayed, or cancelled until such funding is committed.

6.2.6 Other Unidentified Funding

The amount and timing of the traditional airport capital funding sources described in the preceding paragraphs are insufficient to finance a number of capital projects planned for implementation during the planning period. These projects include new concourse and terminal expansion including associated passenger boarding bridges and apron expansion, Snow Removal Equipment (SRE), building pavement expansion, Bravo Hangar area development, and a future parking garage. Consequently, non-traditional funding sources will be needed to finance the cost of projects totaling about $48 million

during the Phase II planning period, and $56.7 million during the Phase III planning period. The source of this "other" funding has not yet been determined and represents a shortfall for the capital project implementation plan. This other funding could include sources such as future private third-party funding, federal economic stimulus grants, City and local economic development funding, State funding and other possible sources that are not certain at this time. If other funding sources cannot be identified and obtained in time to fund the projects, the associated projects will have to be modified, delayed, or cancelled until such funding can be identified. Consequently, this source of capital funding has been referenced in the Financial Implementation Analysis as "Other Unidentified Funding".

6.2.7 Cash Reserves/Airport Net Operating Revenue

At the beginning of 2018, the Airport had accumulated about $4.6 million in unrestricted cash reserves available for operations and capital project funding. The implementation analysis assumes that Airport cash reserves/net operating cash flow will be used throughout the planning period to fund about $56.7 million in project costs. This will include some local grant match requirements, projects or project components ineligible for federal or state funding, or projects for which federal and/or state funding may not be available. The implementation analysis assumes the following funding needed from the Airport's cash reserves/airport operating revenue:

- Phase I: $4.6 million
- Phase II: $16.9 million
- Phase III: $35.2 million

6.3 FINANCIAL ANALYSIS AND IMPLEMENTATION PLAN FOR THE MASTER PLAN CAPITAL IMPROVEMENT PROGRAM

This section, along with the Schedules 6-1 through 6-5 presented at the end of this chapter, documents the analysis of the financial reasonableness of implementing the

Master Plan Capital Improvement Program during the planning period from 2018 through 2035.

6.3.1 Estimated Project Costs and Development Schedule

The Airport Capital Improvement Program (ACIP) Estimated Project Costs and Development Schedule (Schedule 6-1) is derived from previous results of the Master Plan analysis. The ACIP for capital expansion and improvement projects is projected on an annual basis for the Phase I planning period (2018-2020), in total for the Phase II planning period (2021-2025), and in total for the Phase III planning period (2026-2035). For each of these planning periods, Schedule 6-1 (provided at the end of Chapter 6) presents the Capital Improvement Program including estimated costs and anticipated development schedule for the identified projects.

As shown in Schedule 6-1, the estimated cost of projects is $233,957,160 in 2018 dollars. The estimated costs for projects scheduled during the period 2018 through 2035 are adjusted by an assumed 3 percent rate of annual inflation. The resulting total project costs escalated for inflation are $293,097,945. **Table 6-1** presents a summary of the schedule and compares 2018 base year costs with escalated costs adjusted for inflation for each of the planning periods.

6.3.2 Sources and Uses of Capital Funding

Funding sources for the ACIP depend on many factors, including the following:

- Eligibility of AIP and PFC projects
- The ultimate type and use of facilities to be developed
- Management's current and desired levels of the Airport's airline cost per enplaned passenger
- The availability of other financing sources
- The priorities for scheduling project completion.

For master planning purposes, assumptions were made related to the funding source of each capital improvement.

Table 6-1: Summary of 2018 Base Year and Total Escalated Costs for the Master Plan Airport Capital Improvement Program		
Planning Periods	**2018 Base Year Costs**	**Total Escalated Costs**
Phase I Projects (2018-2020)	$29,101,161	$29,837,855
Phase II Projects (2021-2025)	101,644,339	116,104,942
Phase III Projects (2026-2035)	103,211,660	147,155,148
Total Project Costs	**$233,957,160**	**$293,097,945**

Note: Addition errors are due to rounding of calculated amounts.
Source: Leibowitz & Horton AMC analysis

The Projected Capital Funding Sources (Schedule 6-2) (provided at the end of Chapter 6) lists each of the ACIP projects, their estimated costs (escalated annually for inflation), and the assumed funding sources and amounts. During the planning period, it was assumed that AIP entitlement grants would partially fund the following projects:

- Runway/taxiway rehabilitation
- Airfield drainage improvements
- Acquisition of SRE
- Rehabilitation, expansion, and new construction of SRE buildings and pavement
- Rehabilitation and expansion of ARFF buildings
- Acquisition of land for runway protection zones (RPZ)
- Service road extensions
- Aircraft parking aprons
- And instrument approach improvements.

It was assumed that AIP discretionary grants, including supplemental appropriation funds, would partially fund the completion of the rehabilitation of Runway 13-31, other runway and taxiway rehabilitation, airfield drainage improvements, and the acquisition of a new ARFF truck. North Dakota Aeronautics Commission grants are assumed to provide a

portion of the funding for AIP eligible projects as well as funding for hangar disposition, new concourse and terminal expansion, deicing fluid collection and general aviation development. General aviation development includes aircraft apron rehabilitation and expansion and taxilane extension. PFC pay-as-you-go revenues were assumed to fund a portion of AIP eligible projects and acquisition of SRE equipment. Private third-party funding has been identified for the development of the corporate hangar area and fuel farm expansion. Available cash reserves were assumed to fund some local grant match requirements, projects or project components ineligible for federal or state funding, or projects for which federal and/or state funding may not be available. A summary of the sources of capital funding by type and uses of capital funding by planning period for the ACIP is presented in **Table 6-2**.

6.3.3 Projected Operations and Maintenance Expenses

Operations and maintenance expense projections for the planning periods are based on the Airport's 2018 and 2019 budgets, the anticipated impacts of inflation, aviation traffic increases, facility improvements and the recent experience of other airports with similar levels of aviation activity.

6.3.3.1 Operations and Maintenance Expense Projection Assumptions

Operations and maintenance expense growth assumptions, as reflected in Actual, Budgeted and Projected Operations and Maintenance Expenses (Schedule 6-3), were developed to project the Airport’s operating expenses during the planning period. Actual amounts for 2015 through 2017 and budgeted amounts for 2018 and 2019 provide a comparison with expenses projected for the period 2020 through 2035.

Table 6-2: Summary of Sources and Uses of Capital Funding for the Master Plan Airport Capital Improvement Program				
Sources of Capital Funding	**Phase I (2018-2020)**	**Phase II (2021-2025)**	**Phase III (2026-2035)**	**Totals**
AIP Entitlement Grants	$6,699,183	$11,845,633	$27,217,636	**$45,762,452**
AIP Discretionary Grants	16,515,048	20,528,976	9,402,323	**46,446,347**
North Dakota Aeronautics Commission Grants	1,293,469	8,772,330	4,516,398	**14,582,198**
Passenger Facility Charges	736,713	0	9,584,727	**10,321,440**
Other City Capital Contribution	0	10,000,000	0	**10,000,000**
Private Third-Party Funding	0	0	4,525,365	**4,525,365**
Other Unidentified Funding	0	48,024,466	56,719,719	**104,744,185**
Cash Reserves/Net Ops Cash Flow	4,593,441	16,933,536	35,188,979	**56,715,957**
Total Sources of Capital Funding	**$29,837,855**	**$116,104,942**	**$147,155,148**	**$293,097,945**
Uses of Capital Funding				
Runway/Taxiway Improvements	$18,568,705	$16,255,317	$659,949	**$35,483,971**
Apron Improvements (Commercial and General Aviation)	692,639	9,881,248	13,033,593	**23,607,480**
Terminal Building Improvements	0	64,202,527	44,310,866	**108,513,393**
Roadway and Parking Improvements	1,909,416	0	33,908,811	**35,818,227**
General Aviation Facility Improvements	42,624	1,555,202	4,713,922	**6,311,748**
Land Acquisition	0	0	4,009,315	**4,009,315**
Drainage Improvements	7,095,091	13,092,280	20,660,209	**40,847,581**
ARFF Building and Equipment	0	3,398,957	0	**3,398,957**
SRE Building and Equipment	1,284,292	6,813,022	17,017,259	**25,114,573**
Other Improvements	245,088	906,389	8,841,223	**9,992,700**
Total Uses of Capital Funding	**$29,837,855**	**$116,104,942**	**$147,155,148**	**$293,097,945**

Note: Addition errors are due to rounding of calculated amounts.

Source: Leibowitz & Horton AMC analysis

The Airport's Operations and Maintenance expenses are classified into the following seven cost centers:

- Administration
- Buildings
- Property and Land
- Equipment and Vehicles
- Security
- ARFF
- Operations.

For each of the following expense categories listed below, projections are based on 2019 budgeted amounts with an assumed 3 percent annual rate of inflation beginning in 2020.

- Personal Services – Salaries and Wages
- Personal Services – Fringe Benefits
- Professional, Legal, and Contracted Service Fees
- Building, Equipment, and Vehicle Services
- Travel and Training
- Other Operating Services
- Operating Supplies
- Other Financing Uses
- Capital Expenses (minor)

6.3.3.2 Projection of Operations and Maintenance Expenses and Operating Expenses Per Enplaned Passenger

The projection of operations and maintenance expenses is provided in Actual, Budgeted and Projected Operations and Maintenance Expenses (Schedule 6-3) (provided at the end of Chapter 6). As shown in the schedule, total expenses are expected to grow from $5,283,170 budgeted in 2018 to $5,301,739 projected in 2020 and total $15,732,228 during the Phase I planning period. Phase II expenses are projected to total $28,992,080 reflecting a 3 percent annual growth rate for the five-year period 2021-2025 and Phase

III expenses are projected to total $72,572,697 reflecting a 3 percent annual growth rate for the ten-year period 2026-2035.

Schedule 6-3 also compares BIS's total operating expenses per enplaned passenger with expenses for non-hub airports with similar levels of aviation activity. BIS's operating expenses per enplaned passenger are projected to increase from $17.72 budgeted for 2019 to an average of $18.49 during the Phase III planning period. Over the same period, the overall non-hub industry average grows from $48.04 in 2019 to $54.25 during Phase III (Source: *Non-Hub Airports, FAA Operating and Financial Summary Report #127* and FAA Air Carrier Activity Information System enplanement database). These comparisons show that budgeted and projected operating expenses at BIS are substantially lower than other non-hub airports of similar size during all three phases of the planning period. This implies that the Airport currently manages operations and controls expenses in a more cost-efficient manner than other comparable non-hub airports.

6.3.4 Projected Operating Revenues

Operating revenue projections for the planning periods are based on:

- The Airport's 2018 and 2019 budgets
- Current rates and charges methodology
- Current leasing practices
- The anticipated impacts of inflation
- Aviation traffic increases
- Facility expansions
- The recent experience of other airports with similar levels of aviation activity.

6.3.4.1 Operating Revenue Projection Assumptions

Operating revenue growth assumptions, as reflected in Actual, Budgeted and Projected Operating Revenues (Schedule 6-4) (provided at the end of Chapter 6), were developed to project the Airport's operating revenues during the planning period. Actual amounts for

2015 through 2017 and budgeted amounts for 2018 and 2019 provide a comparison with projected revenues for 2020 through 2035. This analysis organizes revenues into categories for airline revenues, non-airline revenues, and non-operating revenues. Annual revenue growth assumptions for 2020 through 2035 are provided in the following sections.

Airline Revenues

Landing fees – Airline landing fee projections beginning in 2020 are based on the Airport's 2019 budget with growth thereafter at a 3 percent annual rate of inflation plus increases in aircraft landed weight assuming one half the annual growth rate of the Master Plan forecast of passenger enplanements. This reflects the airlines' practice of managing increased load factors before additional flights are provided.

Air Carrier Rents and Fees – At BIS, air carriers pay rent for their space in the terminal building as well as for the usage of the jetways (passenger loading bridges) and pay fees for security and ARFF services. Projections for air carrier operations/rent beginning in 2020 are based on the 2019 budget with growth thereafter at a 3 percent annual rate of inflation.

Non-Airline Revenues

Non-Airline revenue projections beginning in 2020 for the following categories are based on the Airport's 2019 budget with growth at a 3 percent annual inflation rate plus the annual rate of forecast enplanement growth:

- Auto Parking Revenues
- Food and Beverage Concessions
- News and Gift Concessions
- Rental Car Concessions

Non-Airline revenue projections beginning in 2020 for the following categories are based on the Airport's 2019 budget with growth at a 3 percent annual inflation rate thereafter:

- Cargo/Charter/General Aviation Landing Fees
- Fuel Flowage Fees/Fuel Farm
- Aeronautical – Land/Ground Leases
- Other Aeronautical Building Leases
- Non-Aeronautical – Land/Ground Leases
- Other Non-Aeronautical Building Leases
- Advertising
- Rental Car Space Revenue (Parking)
- Lodging, Liquor and Food Tax
- Other Aeronautical Taxes, Permits and Fees
- Other Rent and Concessions
- Other Revenue

Non-Operating Revenues – Non-Operating revenue projections beginning in 2020 for Interest Income, Gain/Loss on Disposal of Assets, and Other Revenue are based on the Airport's 2019 budget and are assumed to remain flat throughout the planning period.

6.3.4.2 Projection of Operating Revenues, Airline Cost Per Enplaned Passenger and Operating Revenues Per Enplaned Passenger

The projection of operating revenues is provided in Schedule 6-4 at the end of Chapter 6. As shown in the schedule, airline revenues are expected to grow from $1,768,898 budgeted in 2018 to $1,983,218 projected for 2020 and total $5,673,713 during the Phase I planning period. During the Phase II period, airline revenues are projected to total $10,944,738 and during the Phase III period, revenues are projected to total $28,007,392. The overall annual growth rate for airline revenues is 3.6 percent during the planning period. Non-Airline revenues are expected to grow from $3,981,396 budgeted in 2018 to $4,439,279 projected for 2020 and total $12,672,915 during the Phase I planning period.

During the Phase II period, non-airline revenues are projected to total $25,812,675 and during the Phase III period, non-airline revenues are projected to total $74,741,114. The overall annual growth rate for non-airline revenues is 5.1 percent. Total Airport revenues (including non-operating revenues) are expected to grow from $5,852,094 budgeted in 2018 to $6,513,832 projected for 2020 and total $18,631,098 during the Phase I planning period. During the Phase II period, revenues are projected to total $37,214,089 and during the Phase III period, revenues are projected to total $103,661,856. The overall annual growth rate for total Airport revenues is 4.6 percent.

Schedule 6-4 also provides a comparison of the Airport's airline cost per enplaned passenger (CPEP) versus non-hub airports with similar levels of aviation activity. The airline CPEP (all airline fees and rentals divided by enplaned passengers) is a measure that airlines use to compare their cost of operations among the airports they serve. BIS's airline CPEP is projected to grow from $6.61 budgeted in 2019 to an average of $7.13 during the Phase III planning period. Over the same period, the overall non-hub industry average grows from $9.38 in 2019 to $10.54 during Phase III (Source: Non-Hub Airports, FAA Operating and Financial Summary Report #127 and FAA Air Carrier Activity Information System enplanement database).

This comparison indicates that airline rates and charges at BIS are approximately 30 percent lower than the industry average. This indicates that the Airport has room to grow airline rates and charges in the future if there is a need or justification to do so. Currently, the Airport considers its low CPEP as beneficial in its efforts to attract new airlines and increase service. The Airport should continue to monitor their rates in comparison with the non-hub industry average and other comparable peer airports.

Schedule 6-4 also provides a comparison of BIS's total operating revenue per enplaned passenger versus an average for other non-hub airports. The Airport's total operating

revenue per enplaned passenger is projected to grow from $21.25 budgeted for 2019 to an average of $26.17 during the Phase III planning period. Over the same period, the overall non-hub industry average grows from $48.38 in 2019 to $54.36 (Source: *Non-Hub airports, FAA Operating and Financial Summary Report #127* and FAA Air Carrier Activity Information System enplanement database). These comparisons show that both airline and non-airline revenues are much lower than the non-hub industry averages throughout the planning period.

BIS does have a diverse source of non-airline revenues including aeronautical and non-aeronautical land/ground rents and building rents and terminal related revenues such as concessions, advertising, parking, and rental car concessions. Upon more detailed analysis, it does not appear that any specific category of non-airline revenues is significantly below that of the non-hub industry average. Combined concession revenues from food/beverage and news/gift per enplaned passenger for 2019 are comparable with the non-hub industry average. Parking revenue per enplaned passenger estimated for 2019 is approximately $5.84, 9 percent below the non-hub industry average. Rental car concession revenue also falls below average at approximately $3.22 per enplaned passenger versus $4.77 per enplaned passenger for the non-hub average. This shortfall is despite an above average concession rate of 11.5 percent compared to industry average of 10 percent. This may, however, reflect specific passenger behavior at BIS (lower than average number of passengers who rent vehicles) or a lower daily rental rate for the BIS market.

Other non-airline revenues such as land/ground leases may be low due to the limited availability of space available to rent compared with other similar airports. Additionally, by securing capital funding for facilities such as general aviation aircraft parking aprons from AIP funding, the Airport does not exclusively lease these areas as may be the case at

other airports. Additionally, the airport's current fuel flowage rate is lower than industry average and has not been raised in many years.

The Airport's overall policies for setting/negotiating airline and non-airline user fees and rental rates could be reviewed and adjusted over time to establish rates that are more comparable with other airports having similar levels of aviation activity.

6.3.5 Financial Plan Summary for the Master Plan Capital Improvement Program

The Financial Plan Summary in Schedule 6-5 at the end of Chapter 6 includes a Capital Cash Flow section that presents a summary of projected capital funding (from Schedule 6-2) and scheduled capital expenditures (from Schedule 6-1) with the cash flow that results from implementing the Master Plan Airport Capital Improvement Program. Schedule 6-5 also includes an Operating Cash Flow section that summarizes totals for operating revenues (from Schedule 6-4) and operating expenses (from Schedule 6-3) with the addition of beginning cash reserve balances to provide the cash flow that results from these activities.

In Schedule 6-1 of the Financial Implementation Analysis, practical approaches were provided for scheduling capital expenditures to match the availability of capital funding. Schedule 6-2 provided practical approaches for matching specific capital funding sources with each of the identified projects. As shown in Schedule 6-5, positive year end cash reserves are projected throughout the planning period 2018 to 2035.

Based on the assumptions underlying the Financial Implementation Analysis summarized in the Capital Cash Flow section of Schedule 6-5, implementation of projects in the Master Plan ACIP that are scheduled throughout the planning period are projected to be financially reasonable if the City can identify approximately $56.7 million in funding for projects with Other Unidentified Funding. If funding sources are not available for these

projects and other alternative sources cannot be identified, then development of these projects will not be feasible during the implementation period that is currently planned.

Implementation of other capital projects during the 2018-2035 planning period that have AIP discretionary grants indicated as a funding source are subject to the availability of those grants provided at the sole discretion of the FAA. If the identified portion of discretionary funding is not awarded by the FAA, then these projects will need to be delayed until funding is available.

Additionally, the Financial Implementation Analysis relies on achievement of the aviation activity and passenger enplanement forecast. Actual aviation traffic may temporarily vary from the projected levels of activity without a significant adverse impact on the capital program. If decreased traffic levels occur and persist, implementation of all the proposed projects may not be financially feasible; however, if the forecast activity levels are not met, then several of the planned capital improvements may not be necessary. The Financial analysis Schedules 6-1 through 6-5 are presented on the following pages.

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Schedule 6-1

Master Plan - Financial Implementation Analysis
Estimated Project Costs and Development Schedule

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Capital Improvement Program	Funding Schedule						
	Phase I				Phase II	Phase III	Total
	2018	2019	2020	Total	2021-2025	2026-2035	Funding
Funds Used for Capital Improvement Projects							
AIP Entitlement Grants:	$2,204,696	$2,232,875	$2,261,612	$6,699,183	$11,845,633	$27,217,636	$45,762,452
AIP Entitlements carryover from the prior years	0	0	0	0	0	0	0
AIP Entitlement unspent current year + carryover	0	0	0	0	0	0	0
AIP Discretionary/Supplemental Grants	9,760,091	3,074,144	3,680,813	16,515,048	20,528,976	9,402,323	46,446,347
ND Aeronautics Grants	668,500	294,834	330,135	1,293,469	8,772,330	4,516,398	14,582,198
Passenger Facility Charges (Reimbursement of Pre-2018 Projects)	389,027	1,148,006	1,170,713	2,707,746	6,379,376	5,926,164	15,013,287
Passenger Facility Charges (2018 Forward Projects):	736,713	0	0	736,713	0	9,584,728	10,321,441
PFC beginning year unliquidated balance	0	0	0	0	0	0	0
PFC unspent current year + carryover	0	0	0	0	0	0	0
Other City Capital Contribution	0	0	0	0	10,000,000	0	10,000,000
Private 3rd Party Funding	0	0	0	0	0	4,525,365	4,525,365
Other Unidentified Funding	0	0	0	0	48,024,466	56,719,719	104,744,185
Net Operating Cash Flow	568,924	1,117,853	1,212,093	2,898,870	8,222,009	31,089,159	42,210,039
Funds Available Current Year	14,327,951	7,867,713	8,655,366	30,851,031	113,772,792	148,981,492	293,605,314
Beginning Cash Balance/Funds Carried Over from Prior Year	4,600,654	5,435,395	6,175,428	4,600,654	5,613,830	3,281,679	4,600,654
Funds Used Current Year	(13,493,210)	(7,127,680)	(9,216,964)	(29,837,855)	(116,104,942)	(147,155,148)	(293,097,945)
Funds Carried Over to Next Year	$5,435,395	$6,175,428	$5,613,830	$5,613,830	$3,281,679	$5,108,023	$5,108,023

Capital Project Description		2018 Base Year Costs	Estimated Project Costs and Development Schedule						
			Phase I				Phase II	Phase III	Total Escalated
			2018	2019	2020	Total	2021-2025	2026-2035	Costs
Phase I Projects (2018-2020)									
Capital Projects 2018									
I-2	Short Term Parking Lot Rehabilitation (Rejuvenation)	$123,210	$123,210			$123,210			$123,210
I-3	Runway 13-31 Reconstruction - Phase 4 (Design & Construction)	13,370,000	13,370,000			13,370,000			13,370,000
	Total Capital Projects 2018	$13,493,210	$13,493,210	$0	$0	$13,493,210	$0	$0	$13,493,210
Capital Projects 2019									
I-9	Jetway Ave, Corp. Circle, and Lancair Drive Rehab (rejuvenation) (Design and Construction)	$147,852		$152,288		$152,288			$152,288
I-20	Plans & Specifications for Airfield Drainage Improv to Eliminate Wildlife Hazards. - Phase 5a, 5b and 5c (on Airport) (Central Watershed Channel Improvements & Wetland Improvements)	985,680		1,015,250		1,015,250			1,015,250
I-10	Purchase SRE Equipment	739,260		761,438		761,438			761,438

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Capital Improvement Program	Funding Schedule						
	Phase I				Phase II	Phase III	Total
	2018	2019	2020	Total	2021-2025	2026-2035	Funding
Funds Used for Capital Improvement Projects							
AIP Entitlement Grants:	$2,204,696	$2,232,875	$2,261,612	$6,699,183	$11,845,633	$27,217,636	$45,762,452
AIP Entitlements carryover from the prior years	0	0	0	0	0	0	0
AIP Entitlement unspent current year + carryover	0	0	0	0	0	0	0
AIP Discretionary/Supplemental Grants	9,760,091	3,074,144	3,680,813	16,515,048	20,528,976	9,402,323	46,446,347
ND Aeronautics Grants	668,500	294,834	330,135	1,293,469	8,772,330	4,516,398	14,582,198
Passenger Facility Charges (Reimbursement of Pre-2018 Projects)	389,027	1,148,006	1,170,713	2,707,746	6,379,376	5,926,164	15,013,287
Passenger Facility Charges (2018 Forward Projects):	736,713	0	0	736,713	0	9,584,728	10,321,441
PFC beginning year unliquidated balance	0	0	0	0	0	0	0
PFC unspent current year + carryover	0	0	0	0	0	0	0
Other City Capital Contribution	0	0	0	0	10,000,000	0	10,000,000
Private 3rd Party Funding	0	0	0	0	0	4,525,365	4,525,365
Other Unidentified Funding	0	0	0	0	48,024,466	56,719,719	104,744,185
Net Operating Cash Flow	568,924	1,117,853	1,212,093	2,898,870	8,222,009	31,089,159	42,210,039
Funds Available Current Year	14,327,951	7,867,713	8,655,366	30,851,031	113,772,792	148,981,492	293,605,314
Beginning Cash Balance/Funds Carried Over from Prior Year	4,600,654	5,435,395	6,175,428	4,600,654	5,613,830	3,281,679	4,600,654
Funds Used Current Year	(13,493,210)	(7,127,680)	(9,216,964)	(29,837,855)	(116,104,942)	(147,155,148)	(293,097,945)
Funds Carried Over to Next Year	$5,435,395	$6,175,428	$5,613,830	$5,613,830	$3,281,679	$5,108,023	$5,108,023

			Estimated Project Costs and Development Schedule						
		2018	Phase I				Phase II	Phase III	Total
	Capital Project Description	Base Year Costs	2018	2019	2020	Total	2021-2025	2026-2035	Escalated Costs
I-12	Taxiway C North Rehabilitation (Mill and Overlay) (Design and Construction)	4,000,000		4,120,000		4,120,000			4,120,000
I-13-I18/I19	Plans & Specifications for 3-21 and Twy D Rehabilitation (incl engineering report and geotech investigation)	1,047,286		1,078,705		1,078,705			1,078,705
	Total Capital Projects 2019	$6,920,078	$0	$7,127,680	$0	$7,127,680	$0	$0	$7,127,680
Capital Projects 2020									
I-16	Expand Passenger Parking	$1,540,125			$1,633,919	$1,633,919			$1,633,919
I-17	Purchase Plow or Broom	492,840			522,854	522,854			522,854
I-15-I1	P&S - Hangar 5 Disposition	40,177			42,624	42,624			42,624
I-15-I4	P&S - Expand GA Apron to Northwest - Phase 4	267,848			284,160	284,160			284,160
II-3a	Airfield Drainage Improvements to Eliminate Wildlife Hazards- Phase 5a (On Airport-Runway 31) (Central Watershed Channel Improvements & Wetland Improvements)	$5,730,833			6,079,841	6,079,841			6,079,841
I-21-II4	P&S - Deicing Fluid Collection (per Drainage Study)	231,019			245,088	245,088			245,088

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Capital Improvement Program	Funding Schedule						
	Phase I				Phase II	Phase III	Total
	2018	2019	2020	Total	2021-2025	2026-2035	Funding
Funds Used for Capital Improvement Projects							
AIP Entitlement Grants:	$2,204,696	$2,232,875	$2,261,612	$6,699,183	$11,845,633	$27,217,636	$45,762,452
AIP Entitlements carryover from the prior years	0	0	0	0	0	0	0
AIP Entitlement unspent current year + carryover	0	0	0	0	0	0	0
AIP Discretionary/Supplemental Grants	9,760,091	3,074,144	3,680,813	16,515,048	20,528,976	9,402,323	46,446,347
ND Aeronautics Grants	668,500	294,834	330,135	1,293,469	8,772,330	4,516,398	14,582,198
Passenger Facility Charges (Reimbursement of Pre-2018 Projects)	389,027	1,148,006	1,170,713	2,707,746	6,379,376	5,926,164	15,013,287
Passenger Facility Charges (2018 Forward Projects):	736,713	0	0	736,713	0	9,584,728	10,321,441
PFC beginning year unliquidated balance	0	0	0	0	0	0	0
PFC unspent current year + carryover	0	0	0	0	0	0	0
Other City Capital Contribution	0	0	0	0	10,000,000	0	10,000,000
Private 3rd Party Funding	0	0	0	0	0	4,525,365	4,525,365
Other Unidentified Funding	0	0	0	0	48,024,466	56,719,719	104,744,185
Net Operating Cash Flow	568,924	1,117,853	1,212,093	2,898,870	8,222,009	31,089,159	42,210,039
Funds Available Current Year	14,327,951	7,867,713	8,655,366	30,851,031	113,772,792	148,981,492	293,605,314
Beginning Cash Balance/Funds Carried Over from Prior Year	4,600,654	5,435,395	6,175,428	4,600,654	5,613,830	3,281,679	4,600,654
Funds Used Current Year	(13,493,210)	(7,127,680)	(9,216,964)	(29,837,855)	(116,104,942)	(147,155,148)	(293,097,945)
Funds Carried Over to Next Year	$5,435,395	$6,175,428	$5,613,830	$5,613,830	$3,281,679	$5,108,023	$5,108,023

Capital Project Description		2018 Base Year Costs	Estimated Project Costs and Development Schedule						
			Phase I				Phase II	Phase III	Total Escalated
			2018	2019	2020	Total	2021-2025	2026-2035	Costs
I-22-II5	P&S - Commercial and GA Ramp Panel Replacement	385,031			408,479	408,479			408,479
	Total Capital Projects 2020	$8,687,873	$0	$0	$9,216,964	$9,216,964	$0	$0	$9,216,964
	Total Phase I Project Costs	$29,101,161	$13,493,210	$7,127,680	$9,216,964	$29,837,855	$0	$0	$29,837,855

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Capital Improvement Program	Funding Schedule						
	Phase I				Phase II	Phase III	Total
	2018	2019	2020	Total	2021-2025	2026-2035	Funding
Funds Used for Capital Improvement Projects							
AIP Entitlement Grants:	$2,204,696	$2,232,875	$2,261,612	$6,699,183	$11,845,633	$27,217,636	$45,762,452
AIP Entitlements carryover from the prior years	0	0	0	0	0	0	0
AIP Entitlement unspent current year + carryover	0	0	0	0	0	0	0
AIP Discretionary/Supplemental Grants	9,760,091	3,074,144	3,680,813	16,515,048	20,528,976	9,402,323	46,446,347
ND Aeronautics Grants	668,500	294,834	330,135	1,293,469	8,772,330	4,516,398	14,582,198
Passenger Facility Charges (Reimbursement of Pre-2018 Projects)	389,027	1,148,006	1,170,713	2,707,746	6,379,376	5,926,164	15,013,287
Passenger Facility Charges (2018 Forward Projects):	736,713	0	0	736,713	0	9,584,728	10,321,441
PFC beginning year unliquidated balance	0	0	0	0	0	0	0
PFC unspent current year + carryover	0	0	0	0	0	0	0
Other City Capital Contribution	0	0	0	0	10,000,000	0	10,000,000
Private 3rd Party Funding	0	0	0	0	0	4,525,365	4,525,365
Other Unidentified Funding	0	0	0	0	48,024,466	56,719,719	104,744,185
Net Operating Cash Flow	568,924	1,117,853	1,212,093	2,898,870	8,222,009	31,089,159	42,210,039
Funds Available Current Year	14,327,951	7,867,713	8,655,366	30,851,031	113,772,792	148,981,492	293,605,314
Beginning Cash Balance/Funds Carried Over from Prior Year	4,600,654	5,435,395	6,175,428	4,600,654	5,613,830	3,281,679	4,600,654
Funds Used Current Year	(13,493,210)	(7,127,680)	(9,216,964)	(29,837,855)	(116,104,942)	(147,155,148)	(293,097,945)
Funds Carried Over to Next Year	$5,435,395	$6,175,428	$5,613,830	$5,613,830	$3,281,679	$5,108,023	$5,108,023

Capital Project Description		2018 Base Year Costs	Estimated Project Costs and Development Schedule						
			Phase I				Phase II	Phase III	Total Escalated
			2018	2019	2020	Total	2021-2025	2026-2035	Costs
Phase II Projects (2021-2025)									
I-1	Hangar 5 Disposition	$369,630				$0	$422,216		$422,216
I-4	Expand GA Apron to Northwest - Phase 4	2,464,200				0	2,814,774		2,814,774
II-3b	Airfield Drainage Improvements to Eliminate Wildlife Hazards- Phase 5b (On Airport-Runway 31) (Central Watershed Channel Improvements & Wetland Improvements)	5,730,833				0	6,546,140		6,546,140
II-3c	Airfield Drainage Improvements to Eliminate Wildlife Hazards- Phase 5c (On Airport-Runway 31) (Central Watershed Channel Improvements & Wetland Improvements)	5,730,834				0	6,546,141		6,546,141
II-1	New Concourse and Terminal Expansion	48,271,250				0	55,138,641		55,138,641
II-2	New Boarding Bridges (4 total)	7,935,000				0	9,063,886		9,063,886
II-19	Terminal Apron Expansion-Phase 1	3,174,000				0	3,625,554		3,625,554
I-18	Runway 3-21 Rehabilitation	8,501,490				0	9,710,969		9,710,969

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Capital Improvement Program	Funding Schedule						
	Phase I				Phase II	Phase III	Total
	2018	2019	2020	Total	2021-2025	2026-2035	Funding
Funds Used for Capital Improvement Projects							
AIP Entitlement Grants:	$2,204,696	$2,232,875	$2,261,612	$6,699,183	$11,845,633	$27,217,636	$45,762,452
AIP Entitlements carryover from the prior years	0	0	0	0	0	0	0
AIP Entitlement unspent current year + carryover	0	0	0	0	0	0	0
AIP Discretionary/Supplemental Grants	9,760,091	3,074,144	3,680,813	16,515,048	20,528,976	9,402,323	46,446,347
ND Aeronautics Grants	668,500	294,834	330,135	1,293,469	8,772,330	4,516,398	14,582,198
Passenger Facility Charges (Reimbursement of Pre-2018 Projects)	389,027	1,148,006	1,170,713	2,707,746	6,379,376	5,926,164	15,013,287
Passenger Facility Charges (2018 Forward Projects):	736,713	0	0	736,713	0	9,584,728	10,321,441
PFC beginning year unliquidated balance	0	0	0	0	0	0	0
PFC unspent current year + carryover	0	0	0	0	0	0	0
Other City Capital Contribution	0	0	0	0	10,000,000	0	10,000,000
Private 3rd Party Funding	0	0	0	0	0	4,525,365	4,525,365
Other Unidentified Funding	0	0	0	0	48,024,466	56,719,719	104,744,185
Net Operating Cash Flow	568,924	1,117,853	1,212,093	2,898,870	8,222,009	31,089,159	42,210,039
Funds Available Current Year	14,327,951	7,867,713	8,655,366	30,851,031	113,772,792	148,981,492	293,605,314
Beginning Cash Balance/Funds Carried Over from Prior Year	4,600,654	5,435,395	6,175,428	4,600,654	5,613,830	3,281,679	4,600,654
Funds Used Current Year	(13,493,210)	(7,127,680)	(9,216,964)	(29,837,855)	(116,104,942)	(147,155,148)	(293,097,945)
Funds Carried Over to Next Year	$5,435,395	$6,175,428	$5,613,830	$5,613,830	$3,281,679	$5,108,023	$5,108,023

	Capital Project Description	2018 Base Year Costs	Estimated Project Costs and Development Schedule						
			Phase I				Phase II	Phase III	Total Escalated
			2018	2019	2020	Total	2021-2025	2026-2035	Costs
I-19	Taxiway D Rehabilitation	5,729,265				0	6,544,349		6,544,349
II-4	Deicing Fluid Collection (per Drainage Study)	793,500				0	906,389		906,389
II-5	Commercial and GA Ramp Panel Replacement	1,322,500				0	1,510,648		1,510,648
II-6	Rehabilitate/Expand ARFF Building/ARFF Building Addition	1,983,750				0	2,265,972		2,265,972
II-10	New ARFF Truck	991,875				0	1,132,986		1,132,986
II-11	Rehabilitate/Expand Existing SRE Building	2,823,538				0	3,225,233		3,225,233
II-12	SRE Pavement Expansion	2,149,063				0	2,454,803		2,454,803
II-13	Purchase SRE Equipment	991,875				0	1,132,986		1,132,986
II-24	Bravo Hangar Area Development	991,875				0	1,132,986		1,132,986
II-29-II34	P&S - Commercial and GA Ramp Panel Replacement	367,361				0	419,624		419,624
II-34	Commercial and GA Ramp Panel Replacement	1,322,500				0	1,510,648		1,510,648
	Total Phase II Project Costs	$101,644,339	$0	$0	$0	$0	$116,104,942	$0	$116,104,942

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Capital Improvement Program	Funding Schedule						
	Phase I				Phase II	Phase III	Total
	2018	2019	2020	Total	2021-2025	2026-2035	Funding
Funds Used for Capital Improvement Projects							
AIP Entitlement Grants:	$2,204,696	$2,232,875	$2,261,612	$6,699,183	$11,845,633	$27,217,636	$45,762,452
AIP Entitlements carryover from the prior years	0	0	0	0	0	0	0
AIP Entitlement unspent current year + carryover	0	0	0	0	0	0	0
AIP Discretionary/Supplemental Grants	9,760,091	3,074,144	3,680,813	16,515,048	20,528,976	9,402,323	46,446,347
ND Aeronautics Grants	668,500	294,834	330,135	1,293,469	8,772,330	4,516,398	14,582,198
Passenger Facility Charges (Reimbursement of Pre-2018 Projects)	389,027	1,148,006	1,170,713	2,707,746	6,379,376	5,926,164	15,013,287
Passenger Facility Charges (2018 Forward Projects):	736,713	0	0	736,713	0	9,584,728	10,321,441
PFC beginning year unliquidated balance	0	0	0	0	0	0	0
PFC unspent current year + carryover	0	0	0	0	0	0	0
Other City Capital Contribution	0	0	0	0	10,000,000	0	10,000,000
Private 3rd Party Funding	0	0	0	0	0	4,525,365	4,525,365
Other Unidentified Funding	0	0	0	0	48,024,466	56,719,719	104,744,185
Net Operating Cash Flow	568,924	1,117,853	1,212,093	2,898,870	8,222,009	31,089,159	42,210,039
Funds Available Current Year	14,327,951	7,867,713	8,655,366	30,851,031	113,772,792	148,981,492	293,605,314
Beginning Cash Balance/Funds Carried Over from Prior Year	4,600,654	5,435,395	6,175,428	4,600,654	5,613,830	3,281,679	4,600,654
Funds Used Current Year	(13,493,210)	(7,127,680)	(9,216,964)	(29,837,855)	(116,104,942)	(147,155,148)	(293,097,945)
Funds Carried Over to Next Year	$5,435,395	$6,175,428	$5,613,830	$5,613,830	$3,281,679	$5,108,023	$5,108,023

Capital Project Description		2018 Base Year Costs	Estimated Project Costs and Development Schedule						
			Phase I				Phase II	Phase III	Total Escalated
			2018	2019	2020	Total	2021-2025	2026-2035	Costs
Phase III Projects (2026-2035)									
II-21	Purchase SRE Equipment	$991,875				$0		$1,414,177	$1,414,177
III-17	Expand GA Apron to Northwest - Phase 5	2,000,000				0		2,851,522	2,851,522
II-8-II14	P&S - Airfield Drainage Improvements to Eliminate Wildlife Hazards - Phase 6 (On Airport - Runway 3) (Storm Sewer with Force Main)	361,947				0		516,050	516,050
II-9-II15	P&S - Runway 13 RPZ Land Purchase - Phase 2	167,053				0		238,178	238,178
II-14	Airfield Drainage Improvements to Eliminate Wildlife Hazards - Phase 6 (On Airport - Runway 3) (Storm Sewer with Force Main)	5,730,833				0		8,170,798	8,170,798
II-15	Runway 13 RPZ Land Purchase - Phase 2	2,645,000				0		3,771,138	3,771,138
II-17-II22	P&S - Airfield Drainage Improvements to Eliminate Wildlife Hazards- Flood Control Levee	514,703				0		733,843	733,843
II-18-II23	P&S - Airfield Drainage Improvements to Eliminate Wildlife Hazards- General Aviation	543,297				0		774,612	774,612
II-25-II30	P&S - Service Road Expansion-Phase 3	183,681				0		261,885	261,885

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Capital Improvement Program	Funding Schedule						
	Phase I				Phase II	Phase III	Total
	2018	2019	2020	Total	2021-2025	2026-2035	Funding
Funds Used for Capital Improvement Projects							
AIP Entitlement Grants:	$2,204,696	$2,232,875	$2,261,612	$6,699,183	$11,845,633	$27,217,636	$45,762,452
AIP Entitlements carryover from the prior years	0	0	0	0	0	0	0
AIP Entitlement unspent current year + carryover	0	0	0	0	0	0	0
AIP Discretionary/Supplemental Grants	9,760,091	3,074,144	3,680,813	16,515,048	20,528,976	9,402,323	46,446,347
ND Aeronautics Grants	668,500	294,834	330,135	1,293,469	8,772,330	4,516,398	14,582,198
Passenger Facility Charges (Reimbursement of Pre-2018 Projects)	389,027	1,148,006	1,170,713	2,707,746	6,379,376	5,926,164	15,013,287
Passenger Facility Charges (2018 Forward Projects):	736,713	0	0	736,713	0	9,584,728	10,321,441
PFC beginning year unliquidated balance	0	0	0	0	0	0	0
PFC unspent current year + carryover	0	0	0	0	0	0	0
Other City Capital Contribution	0	0	0	0	10,000,000	0	10,000,000
Private 3rd Party Funding	0	0	0	0	0	4,525,365	4,525,365
Other Unidentified Funding	0	0	0	0	48,024,466	56,719,719	104,744,185
Net Operating Cash Flow	568,924	1,117,853	1,212,093	2,898,870	8,222,009	31,089,159	42,210,039
Funds Available Current Year	14,327,951	7,867,713	8,655,366	30,851,031	113,772,792	148,981,492	293,605,314
Beginning Cash Balance/Funds Carried Over from Prior Year	4,600,654	5,435,395	6,175,428	4,600,654	5,613,830	3,281,679	4,600,654
Funds Used Current Year	(13,493,210)	(7,127,680)	(9,216,964)	(29,837,855)	(116,104,942)	(147,155,148)	(293,097,945)
Funds Carried Over to Next Year	$5,435,395	$6,175,428	$5,613,830	$5,613,830	$3,281,679	$5,108,023	$5,108,023

Capital Project Description		2018 Base Year Costs	Estimated Project Costs and Development Schedule						
			Phase I				Phase II	Phase III	Total Escalated
			2018	2019	2020	Total	2021-2025	2026-2035	Costs
II-26-II31	P&S - Relocate Airway Ave/Airport Road Intersection	110,208				0		157,130	157,130
II-30	Service Road Expansion-Phase 3	661,250				0		942,784	942,784
II-31	Relocate Airway Ave/Airport Road Intersection	396,750				0		565,671	565,671
II-35-III1	P&S - Service Road Extension - Phase 4	264,500				0		377,114	377,114
III-1	Service Road Extension - Phase 4	1,322,500				0		1,885,569	1,885,569
III-2	Expand Passenger Parking	6,612,500				0		9,427,844	9,427,844
III-3	Purchase SRE Equipment	991,875				0		1,414,177	1,414,177
III-4	Taxilane Expansion - "B" Area	462,875				0		659,949	659,949
II-22	Airfield Drainage Improvements to Eliminate Wildlife Hazards- Flood Control Levee	3,570,750				0		5,091,036	5,091,036
II-23	Airfield Drainage Improvements to Eliminate Wildlife Hazards- General Aviation	3,769,125				0		5,373,871	5,373,871
III-5-III6	P&S - Construct South Side Service Road	264,500				0		377,114	377,114
III-6	Construct South Side Service Road	1,983,750				0		2,828,353	2,828,353
III-7	Corporate Hangar Area Development	3,306,250				0		4,713,922	4,713,922

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Capital Improvement Program	Funding Schedule						
	Phase I				Phase II	Phase III	Total
	2018	2019	2020	Total	2021-2025	2026-2035	Funding
Funds Used for Capital Improvement Projects							
AIP Entitlement Grants:	$2,204,696	$2,232,875	$2,261,612	$6,699,183	$11,845,633	$27,217,636	$45,762,452
AIP Entitlements carryover from the prior years	0	0	0	0	0	0	0
AIP Entitlement unspent current year + carryover	0	0	0	0	0	0	0
AIP Discretionary/Supplemental Grants	9,760,091	3,074,144	3,680,813	16,515,048	20,528,976	9,402,323	46,446,347
ND Aeronautics Grants	668,500	294,834	330,135	1,293,469	8,772,330	4,516,398	14,582,198
Passenger Facility Charges (Reimbursement of Pre-2018 Projects)	389,027	1,148,006	1,170,713	2,707,746	6,379,376	5,926,164	15,013,287
Passenger Facility Charges (2018 Forward Projects):	736,713	0	0	736,713	0	9,584,728	10,321,441
PFC beginning year unliquidated balance	0	0	0	0	0	0	0
PFC unspent current year + carryover	0	0	0	0	0	0	0
Other City Capital Contribution	0	0	0	0	10,000,000	0	10,000,000
Private 3rd Party Funding	0	0	0	0	0	4,525,365	4,525,365
Other Unidentified Funding	0	0	0	0	48,024,466	56,719,719	104,744,185
Net Operating Cash Flow	568,924	1,117,853	1,212,093	2,898,870	8,222,009	31,089,159	42,210,039
Funds Available Current Year	14,327,951	7,867,713	8,655,366	30,851,031	113,772,792	148,981,492	293,605,314
Beginning Cash Balance/Funds Carried Over from Prior Year	4,600,654	5,435,395	6,175,428	4,600,654	5,613,830	3,281,679	4,600,654
Funds Used Current Year	(13,493,210)	(7,127,680)	(9,216,964)	(29,837,855)	(116,104,942)	(147,155,148)	(293,097,945)
Funds Carried Over to Next Year	$5,435,395	$6,175,428	$5,613,830	$5,613,830	$3,281,679	$5,108,023	$5,108,023

Capital Project Description		2018 Base Year Costs	Estimated Project Costs and Development Schedule						
			Phase I				Phase II	Phase III	Total Escalated
			2018	2019	2020	Total	2021-2025	2026-2035	Costs
III-9	Fuel Farm Expansion	198,375				0		282,835	282,835
III-11	New SRE Building Pavement	3,471,563				0		4,949,619	4,949,619
III-12	New SRE Building	6,480,250				0		9,239,287	9,239,287
III-14	Instrument Approach Improvements - Runway 3 (includes MALSF)	1,322,500				0		1,885,569	1,885,569
II-20	Terminal Apron Expansion-Phase 2	7,141,500				0		10,182,071	10,182,071
III-13	New Parking Garage (includes 450 parking stalls and circulation)	16,663,500				0		23,758,167	23,758,167
III-15	Commercial Service Terminal Expansion (Beyond 2036)	25,127,500				0		35,825,807	35,825,807
III-16	New Boarding Bridges - (Beyond 2036) (3 total)	5,951,250				0		8,485,059	8,485,059
	Total Phase III Project Costs	$103,211,660	$0	$0	$0	$0	$0	$147,155,148	$147,155,148
Total Project Costs		$233,957,160	$13,493,210	$7,127,680	$9,216,964	$29,837,855	$116,104,942	$147,155,148	$293,097,945

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Capital Improvement Projects		Total Escalated Costs	AIP Entitlement Funding	AIP Discretionary/ Supplemental Funding	Total AIP Funding	ND Aeronautics Grants	Passenger Facility Charges (PAYG)	Other City Capital Contribution	Private 3rd Party Funding	Other Unidentified Funding	Cash Reserves/ Net Revs	Total Funding
Phase I Projects (2018-2020)												
Capital Projects 2018												
I-2	Short Term Parking Lot Rehabilitation (Rejuvenation)	$123,210			$0						$123,210	$123,210
I-3	Runway 13-31 Reconstruction - Phase 4 (Design & Construction)	13,370,000	2,204,696	9,760,091	11,964,787	668,500	736,713				0	13,370,000
	Totals for 2018	$13,493,210	$2,204,696	$9,760,091	$11,964,787	$668,500	$736,713	$0	$0	$0	$123,210	$13,493,210
Capital Projects 2019												
I-9	Jetway Ave, Corp. Circle, and Lancair Drive Rehab (rejuvenation) (Design and Construction)	$152,288			$0						$152,288	$152,288
I-20	Plans & Specifications for Airfield Drainage Improv to Eliminate Wildlife Hazards. - Phase 5a, 5b and 5c (on Airport) (Central Watershed Channel Improvements & Wetland Improvements)	1,015,250	913,725		913,725	50,763					50,763	1,015,250
I-10	Purchase SRE Equipment	761,438	685,294		685,294	38,072					38,072	761,438
I-12	Taxiway C North Rehabilitation (Mill and Overlay) (Design and Construction)	4,120,000	633,856	3,074,144	3,708,000	206,000					206,000	4,120,000
I-13-I18/I19	Plans & Specifications for 3-21 and Twy D Rehabilitation (incl engineering report and geotech investigation)	1,078,705			0						1,078,705	1,078,705
	Totals for 2019	$7,127,680	$2,232,875	$3,074,144	$5,307,019	$294,834	$0	$0	$0	$0	$1,525,827	$7,127,680
Capital Projects 2020												
I-16	Expand Passenger Parking	$1,633,919	$0		$0						$1,633,919	$1,633,919
I-17	Purchase Plow or Broom	522,854	470,569		470,569	26,143					26,143	522,854
I-15-I1	P&S - Hangar 5 Disposition	42,624			0						42,624	42,624
I-15-I4	P&S - Expand GA Apron to Northwest - Phase 4	284,160			0						284,160	284,160
II-3a	Airfield Drainage Improvements to Eliminate Wildlife Hazards- Phase 5a (On Airport-Runway 31) (Central Watershed Channel Improvements & Wetland Improvements)	6,079,841	1,791,043	3,680,813	5,471,857	303,992					303,992	6,079,841
I-21-II4	P&S - Deicing Fluid Collection (per Drainage Study)	245,088			0						245,088	245,088
I-22-II5	P&S - Commercial and GA Ramp Panel Replacement	408,479			0						408,479	408,479
	Totals for 2020	$9,216,964	$2,261,612	$3,680,813	$5,942,425	$330,135	$0	$0	$0	$0	$2,944,405	$9,216,964
	Total Phase I Project Funding	$29,837,855	$6,699,183	$16,515,048	$23,214,232	$1,293,469	$736,713	$0	$0	$0	$4,593,441	$29,837,855

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Capital Improvement Projects		Total Escalated Costs	AIP Entitlement Funding	AIP Discretionary/ Supplemental Funding	Total AIP Funding	ND Aeronautics Grants	Passenger Facility Charges (PAYG)	Other City Capital Contribution	Private 3rd Party Funding	Other Unidentified Funding	Cash Reserves/ Net Revs	Total Funding
Phase II Projects (2021-2025)												
I-1	Hangar 5 Disposition	$422,216			$0	$211,108					$211,108	$422,216
I-4	Expand GA Apron to Northwest - Phase 4	2,814,774			0	1,407,387					1,407,387	2,814,774
II-3b	Airfield Drainage Improvements to Eliminate Wildlife Hazards- Phase 5b (On Airport-Runway 31) (Central Watershed Channel Improvements & Wetland Improvements)	6,546,140	2,300,000	3,591,526	5,891,526	327,307					327,307	6,546,140
II-3c	Airfield Drainage Improvements to Eliminate Wildlife Hazards- Phase 5c (On Airport-Runway 31) (Central Watershed Channel Improvements & Wetland Improvements)	6,546,141	2,300,000	3,591,527	5,891,527	327,307					327,307	6,546,141
II-1	New Concourse and Terminal Expansion	55,138,641			0	2,756,932		10,000,000		32,381,709	10,000,000	55,138,641
II-2	New Boarding Bridges (4 total)	9,063,886			0	453,194				8,610,692	0	9,063,886
II-19	Terminal Apron Expansion-Phase 1	3,625,554			0	181,278				3,444,277	0	3,625,554
I-18	Runway 3-21 Rehabilitation	9,710,969	2,303,549	6,436,323	8,739,872	485,548					485,548	9,710,969
I-19	Taxiway D Rehabilitation	6,544,349		5,889,914	5,889,914	327,217					327,217	6,544,349
II-4	Deicing Fluid Collection (per Drainage Study)	906,389			0	453,194					453,194	906,389
II-5	Commercial and GA Ramp Panel Replacement	1,510,648			0	755,324					755,324	1,510,648
II-6	Rehabilitate/Expand ARFF Building/ARFF Building	2,265,972	2,039,374		2,039,374	113,299					113,299	2,265,972
II-10	New ARFF Truck	1,132,986		1,019,687	1,019,687	56,649					56,649	1,132,986
II-11	Rehabilitate/Expand Existing SRE Building	3,225,233	2,902,710		2,902,710	161,262					161,262	3,225,233
II-12	SRE Pavement Expansion	2,454,803			0					2,454,803	0	2,454,803
II-13	Purchase SRE Equipment	1,132,986			0						1,132,986	1,132,986
II-24	Bravo Hangar Area Development	1,132,986			0					1,132,986	0	1,132,986
II-29-II34	P&S - Commercial and GA Ramp Panel Replacement	419,624			0						419,624	419,624
II-34	Commercial and GA Ramp Panel Replacement	1,510,648			0	755,324					755,324	1,510,648
	Total Phase II Project Funding	$116,104,942	$11,845,633	$20,528,976	$32,374,610	$8,772,330	$0	$10,000,000	$0	$48,024,466	$16,933,536	$116,104,942

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Master Plan - Financial Implementation Analysis
Projected Capital Funding Sources

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Capital Improvement Projects		Total Escalated Costs	AIP Entitlement Funding	AIP Discretionary/ Supplemental Funding	Total AIP Funding	ND Aeronautics Grants	Passenger Facility Charges (PAYG)	Other City Capital Contribution	Private 3rd Party Funding	Other Unidentified Funding	Cash Reserves/ Net Revs	Total Funding
Phase III Projects (2026-2035)												
II-21	Purchase SRE Equipment	$1,414,177			$0						$1,414,177	$1,414,177
III-17	Expand GA Apron to Northwest - Phase 5	2,851,522			0	1,425,761					1,425,761	2,851,522
II-8-II14	P&S - Airfield Drainage Improvements to Eliminate Wildlife Hazards - Phase 6 (On Airport - Runway 3) (Storm Sewer with Force Main)	516,050	464,445		464,445	25,802					25,802	516,050
II-9-II15	P&S - Runway 13 RPZ Land Purchase - Phase 2	238,178			0						238,178	238,178
II-14	Airfield Drainage Improvements to Eliminate Wildlife Hazards - Phase 6 (On Airport - Runway 3) (Storm Sewer with Force Main)	8,170,798	2,041,751	5,311,967	7,353,718	$408,540					408,540	8,170,798
II-15	Runway 13 RPZ Land Purchase - Phase 2	3,771,138	2,555,930		2,555,930	$188,557					1,026,651	3,771,138
II-17-II22	P&S - Airfield Drainage Improvements to Eliminate Wildlife Hazards- Flood Control Levee	733,843			0						733,843	733,843
II-18-II23	P&S - Airfield Drainage Improvements to Eliminate Wildlife Hazards- General Aviation	774,612			0						774,612	774,612
II-25-II30	P&S - Service Road Expansion-Phase 3	261,885			0						261,885	261,885
II-26-II31	P&S - Relocate Airway Ave/Airport Road Intersection	157,130			0						157,130	157,130
II-30	Service Road Expansion-Phase 3	942,784	848,506		848,506	47,139					47,139	942,784
II-31	Relocate Airway Ave/Airport Road Intersection	565,671			0						565,671	565,671
II-35-III1	P&S - Service Road Extension - Phase 4	377,114			0						377,114	377,114
III-1	Service Road Extension - Phase 4	1,885,569	1,697,012		1,697,012	94,278					94,278	1,885,569
III-2	Expand Passenger Parking	9,427,844			0						9,427,844	9,427,844
III-3	Purchase SRE Equipment	1,414,177			0		1,414,177				0	1,414,177
III-4	Taxilane Expansion - "B" Area	659,949			0	329,975					329,975	659,949
II-22	Airfield Drainage Improvements to Eliminate Wildlife Hazards- Flood Control Levee	5,091,036	2,628,060	1,953,872	4,581,932	254,552	254,552				0	5,091,036
II-23	Airfield Drainage Improvements to Eliminate Wildlife Hazards- General Aviation	5,373,871	2,700,000	2,136,484	4,836,484	268,694	268,694				0	5,373,871
III-5-III6	P&S - Construct South Side Service Road	377,114	339,402		339,402	18,856	18,856				0	377,114
III-6	Construct South Side Service Road	2,828,353	2,545,518		2,545,518	141,418	141,418				0	2,828,353
III-7	Corporate Hangar Area Development	4,713,922			0				4,242,530		471,392	4,713,922
III-9	Fuel Farm Expansion	282,835			0				282,835		0	282,835
III-11	New SRE Building Pavement	4,949,619	2,800,000		2,800,000	247,481	1,902,138				0	4,949,619
III-12	New SRE Building	9,239,287	2,800,000		2,800,000	461,964	5,053,394				923,929	9,239,287
III-14	Instrument Approach Improvements - Runway 3 (includes MALSF)	1,885,569	1,697,012		1,697,012	94,278	94,278				0	1,885,569
II-20	Terminal Apron Expansion-Phase 2	10,182,071	4,100,000		4,100,000	509,104	437,222			5,135,746		10,182,071
III-13	New Parking Garage (includes 450 parking stalls and circulation)	23,758,167			0					23,758,167	0	23,758,167
III-15	Commercial Service Terminal Expansion (Beyond 2036)	35,825,807			0					27,825,807	8,000,000	35,825,807
III-16	New Boarding Bridges - (Beyond 2036) (3 total)	8,485,059			0						8,485,059	8,485,059
	Total Phase III Project Funding	$147,155,148	$27,217,636	$9,402,323	$36,619,959	$4,516,398	$9,584,727	$0	$4,525,365	$56,719,719	$35,188,979	$147,155,148
Total Project Funding		$293,097,945	$45,762,452	$46,446,347	$92,208,800	$14,582,198	$10,321,440	$10,000,000	$4,525,365	$104,744,185	$56,715,957	$293,097,945

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Master Plan - Financial Implementation Analysis
Actual, Budgeted and Projected Operations & Maintenance Expenses

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Operations & Maintenance Expenses	Actual 2015	Actual 2016	Actual 2017	Phase I Budget 2018	Phase I Budget 2019	Phase I Projected 2020	Phase I Total	Phase II 2021-2025	Phase III 2026-2035
ADMINISTRATION									
Personal Services - Salaries & Wages	$463,511	$470,885	$481,525	$504,426	$507,439	$522,662	$1,534,527	$2,858,131	$7,154,446
Personal Services - Fringe Benefits	145,963	148,399	150,828	156,514	155,844	160,519	472,877	877,785	2,197,264
Professional, Legal and Contracted Service Fees	414,337	83,626	89,400	177,100	179,100	184,473	540,673	1,008,774	2,525,153
Building, Equipment, and Vehicle Services	478,480	4,628	4,402	4,500	4,500	4,635	13,635	25,346	63,446
Travel and Training	17,859	15,337	23,111	29,100	31,125	32,059	92,284	175,310	438,835
Other Operating Services	220,561	167,741	185,308	277,925	279,625	288,014	845,564	1,574,977	3,942,468
Operating Supplies	13,229	10,382	15,177	33,250	31,250	32,188	96,688	176,014	440,598
Other Financing Uses	145,631	167,146	153,667	135,986	159,175	163,950	459,111	896,547	2,244,228
Total Administration	$1,899,572	$1,068,143	$1,103,418	$1,318,801	$1,348,058	$1,388,500	$4,055,359	$7,592,886	$19,006,439
Annual Growth Rate	-	-43.8%	3.3%	19.5%	2.2%	3.0%	8.0%	3.0%	3.0%
BUILDINGS									
Personal Services - Salaries & Wages	$441,822	$463,880	$476,975	$605,268	$611,766	$630,119	$1,847,153	$3,445,749	$8,625,366
Personal Services - Fringe Benefits	157,208	161,962	163,927	215,132	208,668	214,928	638,728	1,175,315	2,942,036
Professional, Legal and Contracted Service Fees	157,446	140,817	105,020	186,848	117,000	120,510	424,358	658,998	1,649,598
Building, Equipment, and Vehicle Services	719,370	515,200	423,666	672,673	601,728	619,780	1,894,181	3,389,210	8,483,839
Other Operating Services	34,602	34,116	31,629	39,237	39,294	40,473	119,004	221,322	554,011
Operating Supplies	86,758	87,815	70,612	97,750	97,950	100,889	296,589	551,700	1,381,009
Capital Expense	952	130,834	0	0	0	0	0	0	0
Total Buildings	$1,598,158	$1,534,624	$1,271,829	$1,816,908	$1,676,406	$1,726,698	$5,220,012	$9,442,293	$23,635,859
Annual Growth Rate	-	-4.0%	-17.1%	42.9%	-7.7%	3.0%	10.7%	3.0%	3.0%
PROPERTY & LAND									
Professional, Legal and Contracted Service Fees	$473,825	$606,578	$278,516	$0	$0	$0	$0	$0	$0
Building, Equipment, and Vehicle Services	117,980	107,597	101,658	221,332	240,499	247,714	709,545	1,354,602	3,390,826
Other Operating Services	0	0	21,458	29,500	21,000	21,630	72,130	118,282	296,082
Operating Supplies	59,990	55,689	37,669	84,500	116,500	119,995	320,995	656,182	1,642,548
Capital Expense	0	0	0	25,000	25,000	25,750	75,750	140,812	352,478
Total Property & Land	$651,795	$769,864	$439,301	$360,332	$402,999	$415,089	$1,178,420	$2,269,877	$5,681,934
Annual Growth Rate	-	18.1%	-42.9%	-18.0%	11.8%	3.0%	-1.9%	3.0%	3.0%
EQUIPMENT & VEHICLES									
Personal Services - Fringe Benefits	$2,010	$1,888	$769	$800	$800	$824	$2,424	$4,506	$11,279
Building, Equipment, and Vehicle Services	91,812	91,210	167,719	140,500	171,000	176,130	487,630	963,151	2,410,950
Other Operating Services	978	4,482	4,929	4,800	4,930	5,078	14,808	27,768	69,509
Operating Supplies	73,290	83,186	53,257	125,450	120,050	123,652	369,152	676,177	1,692,600
Capital Expense	67,575	91,999	5,500	25,000	30,000	30,900	85,900	168,974	422,974
Total Equipment & Vehicles	$235,666	$272,765	$232,174	$296,550	$326,780	$336,583	$959,913	$1,840,576	$4,607,312
Annual Growth Rate	-	15.7%	-14.9%	27.7%	10.2%	3.0%	13.2%	3.0%	3.0%

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Master Plan - Financial Implementation Analysis
Actual, Budgeted and Projected Operations & Maintenance Expenses

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Operations & Maintenance Expenses	Actual 2015	Actual 2016	Actual 2017	Phase I Budget 2018	Phase I Budget 2019	Phase I Projected 2020	Phase I Total	Phase II 2021-2025	Phase III 2026-2035
SECURITY									
Professional, Legal and Contracted Service Fees	$151,444	$220,578	$268,635	$455,026	$390,570	$402,287	$1,247,883	$2,199,871	$5,506,695
Building, Equipment, and Vehicle Services	121	237	350	1,540	1,540	1,586	4,666	8,674	21,713
Travel/Training	0	0	0	12,800	16,000	16,480	45,280	90,119	225,586
Other Operating Services	726	446	10,682	850	850	876	2,576	4,788	11,984
Operating Supplies	3,587	2,424	30,153	14,750	24,750	25,493	64,993	139,403	348,953
Total Security	$155,878	$223,685	$309,820	$484,966	$433,710	$446,721	$1,365,397	$2,442,855	$6,114,932
Annual Growth Rate	-	43.5%	38.5%	56.5%	-10.6%	3.0%	13.0%	3.0%	3.0%
ARFF									
Professional, Legal and Contracted Service Fees	$469,836	$483,924	$498,444	$513,408	$495,000	$509,850	$1,518,258	$2,788,069	$6,979,067
Building, Equipment, and Vehicle Services	2,513	14,195	2,469	8,450	8,450	8,704	25,604	47,594	119,138
Other Operating Services	2,736	2,676	2,724	2,800	2,800	2,884	8,484	15,771	39,478
Operating Supplies	9,566	14,181	8,783	26,485	26,250	27,038	79,773	147,852	370,102
Total ARFF	$484,650	$514,976	$512,420	$551,143	$532,500	$548,475	$1,632,118	$2,999,286	$7,507,784
Annual Growth Rate	-	6.3%	-0.5%	7.6%	-3.4%	3.0%	2.3%	3.0%	3.0%
OPERATIONS									
Personal Services - Salaries & Wages	$296,737	$305,797	$315,449	$318,899	$289,196	$297,872	$905,967	$1,628,886	$4,077,411
Personal Services - Fringe Benefits	110,359	114,118	122,313	124,671	126,670	130,470	381,811	713,464	1,785,936
Travel/Training	0	0	0	6,850	6,850	7,056	20,756	38,582	96,579
Other Operating Services	144	111	309	500	400	412	1,312	2,253	5,640
Operating Supplies	1,870	2,222	2,611	3,550	3,750	3,863	11,163	21,122	52,872
Total Operations	$409,111	$422,248	$440,682	$454,470	$426,866	$439,672	$1,321,008	$2,404,307	$6,018,437
Annual Growth Rate	-	3.2%	4.4%	3.1%	-6.1%	3.0%	-0.1%	3.0%	3.0%
Total Operations & Maintenance Expenses	$5,434,830	$4,806,306	$4,309,644	$5,283,170	$5,147,319	$5,301,739	$15,732,228	$28,992,080	$72,572,697
Annual Growth Rate	-	-11.6%	-10.3%	22.6%	-2.6%	3.0%	7.2%	3.0%	3.0%
Operating Expenses Per Enplaned Passenger:									
Bismarck Airport	$20.71	$17.54	$15.42	$18.54	$17.72	$17.89	$18.05	$17.96	$18.49
Non-Hub Industry Average	$43.78	$46.60	$47.07	$47.55	$48.04	$48.52	$47.56	$50.28	$54.25

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City of Bismarck, North Dakota

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Master Plan - Financial Implementation Analysis
Actual, Budgeted and Projected Operating Revenues

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Revenues	Actual 2015	Actual 2016	Actual 2017	Phase I Budget 2018	Phase I Budget 2019	Phase I Projected 2020	Phase I Total	Phase II 2021-2025	Phase III 2026-2035
						LDW - Landed Weight Growth ENP - Enplanement Growth No Growth			
AIRLINE REVENUES									
Fees - Landing (Airline)	$314,587	$323,799	$361,808	$370,000	$390,000	$405,673	$1,165,673	$2,318,076	$6,413,214
Rent - Terminal Building (Airline)	510,505	524,026	578,570	590,000	590,000	607,700	1,787,700	3,323,153	8,318,484
Rent - Jetway	34,158	40,533	62,887	41,000	62,887	64,774	168,661	354,209	886,652
Fees - Security	78,827	70,036	297,194	364,966	433,710	446,721	1,245,397	2,442,855	6,114,932
Fees - ARFF	371,367	345,337	444,620	402,932	445,000	458,350	1,306,282	2,506,446	6,274,111
Total Airline Revenues	$1,309,445	$1,303,732	$1,745,078	$1,768,898	$1,921,597	$1,983,218	$5,673,713	$10,944,738	$28,007,392
Annual Growth Rate	-	-0.4%	33.9%	1.4%	8.6%	3.2%	4.4%	3.3%	3.3%
Airline Cost Per Enplaned Passenger:									
Bismarck Airport	$4.99	$4.76	$6.25	$6.21	$6.61	$6.69	$6.51	$6.78	$7.13
Non-Hub Industry Average	$8.08	$9.10	$9.20	$9.29	$9.38	$9.48	$9.29	$9.77	$10.54
NON-AIRLINE REVENUES									
Cargo/Charter/GA Landing Fees	$46,954	$13,084	$60,383	$67,733	$85,437	$88,000	$241,170	$481,221	$1,204,587
Fuel Flowage Fees / Fuel Farm	210,190	207,068	182,972	222,000	216,425	222,918	661,343	1,219,006	3,051,403
Aeronautical - Land/Ground Leases	126,752	111,917	149,827	132,049	178,490	183,845	494,384	1,005,338	2,516,553
Other Aeronautical Building Leases	147,706	77,683	141,678	182,528	183,202	188,698	554,428	1,031,878	2,582,988
Non-Aeronautical - Land/Ground Leases	158,395	156,582	140,017	140,017	193,981	199,800	533,798	1,092,591	2,734,962
Other Non-Aeronautical Building Leases	50,921	88,564	89,825	88,935	91,102	93,835	273,872	513,129	1,284,459
Auto Parking Revenues	1,426,692	1,389,814	1,590,929	1,663,773	1,730,687	1,817,866	5,212,326	10,851,982	33,168,471
Food & Beverage Concessions	176,631	108,832	138,727	183,261	172,309	180,989	536,559	1,080,435	3,302,288
News & Gift Concessions	25,981	30,907	29,182	31,614	26,430	27,761	85,805	165,725	506,529
Advertising	39,963	36,461	35,214	41,375	41,375	42,616	125,366	233,043	583,351
Rental Car Concessions	914,515	1,006,377	942,678	906,487	989,812	1,039,671	2,935,970	6,206,450	18,969,664
Rental Car Space Revenue (Parking)	12,060	11,785	11,330	12,060	12,060	12,422	36,542	67,927	170,035
Lodging, Liquor and Food Tax	17,952	18,262	19,183	25,000	25,000	25,750	75,750	140,812	352,478
Other Aeronautical Taxes, Permits and Fees	53,523	55,304	44,496	71,590	46,650	48,050	166,290	262,754	657,724
Other Rent and Concessions	34,031	21,677	23,046	24,685	25,090	25,843	75,618	141,318	353,747
Other Revenues	209,308	173,111	141,612	188,289	234,190	241,216	663,695	1,319,066	3,301,874
Total Non-Airline Revenues	$3,651,573	$3,507,428	$3,741,100	$3,981,396	$4,252,240	$4,439,279	$12,672,915	$25,812,675	$74,741,114
Annual Growth Rate	-	-3.9%	6.7%	6.4%	6.8%	4.4%	5.9%	5.1%	4.9%
NON-OPERATING REVENUES									
Interest Income	$40,031	$38,591	$32,105	$24,650	$22,475	$22,475	$69,600	$112,375	$224,750
Gain/Loss on Disposal of Assets	-11,200	9,938	156,008	40,000	30,000	30,000	100,000	150,000	300,000
Other	9,647	3,867	18,249	37,150	38,860	38,860	114,870	194,300	388,600
Total Non-Operating Revenues	$38,478	$52,396	$206,363	$101,800	$91,335	$91,335	$284,470	$456,675	$913,350
Annual Growth Rate	-	36.2%	293.9%	-50.7%	-10.3%	0.0%	18.9%	0.0%	0.0%
Total Revenues	$4,999,495	$4,863,556	$5,692,541	$5,852,094	$6,265,172	$6,513,832	$18,631,098	$37,214,089	$103,661,856
Annual Growth Rate	-	-2.7%	17.0%	2.8%	7.1%	4.0%	4.6%	4.5%	4.4%
Operating Revenues Per Enplaned Passenger:									
Bismarck Airport	$18.90	$17.56	$19.64	$20.18	$21.25	$21.68	$21.04	$22.77	$26.17
Non-Hub Industry Average	$41.71	$46.93	$47.41	$47.89	$48.38	$48.87	$48.38	$50.38	$54.36

Bismarck AIRPORT Master Plan Update

BISMARCK AIRPORT
City of Bismarck, North Dakota

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Master Plan - Financial Implementation Analysis
Financial Plan Summary
Budgeted and Projected Net Revenues, Capital Funding and Capital Expenditures

01-Nov-18

Operating/Capital Cash Flow	Phase I				Phase II	Phase III
	Budget 2018	Budget 2019	Projected 2020	Total	2021-2025	2026-2035
Passenger Enplanements	284,925	290,561	296,308	871,794	1,614,623	3,925,814
Annual Growth Rates	1.98%	1.98%	1.98%	1.98%	2.88%	2.52%
Operating Cash Flow						
Revenues:						
Airline Revenues	$1,768,898	$1,921,597	$1,983,218	$5,673,713	$10,944,738	$28,007,392
Non-Airline Revenues	3,981,396	4,252,240	4,439,279	12,672,915	25,812,675	74,741,114
Non-Operating Revenues	101,800	91,335	91,335	284,470	456,675	913,350
Total Revenues	$5,852,094	$6,265,172	$6,513,832	$18,631,098	$37,214,089	$103,661,856
Operations & Maintenance Expenses	(5,283,170)	(5,147,319)	(5,301,739)	(15,732,228)	(28,992,080)	(72,572,697)
Net Operating Cash Flow	$568,924	$1,117,853	$1,212,093	$2,898,870	$8,222,009	$31,089,159
Less Existing Debt Service	0	0	0	0	0	0
Total Net Operating Cash Flow Available For Capital Expenditures	$568,924	$1,117,853	$1,212,093	$2,898,870	$8,222,009	$31,089,159
Capital Cash Flow						
Beginning Cash Balance	$4,600,654	$5,435,395	$6,175,428	$4,600,654	$5,613,830	$3,281,679
Other Capital Funding Sources:						
AIP Entitlement Grants:	$2,204,696	$2,232,875	$2,261,612	$6,699,183	$11,845,633	$27,217,636
AIP Entitlement unspent current year + carryover	0	0	0	0	0	0
AIP Entitlements carryover from the prior years	0	0	0	0	0	0
AIP Discretionary/Supplemental Grants	9,760,091	3,074,144	3,680,813	16,515,048	20,528,976	9,402,323
ND Aeronautics Grants	668,500	294,834	330,135	1,293,469	8,772,330	4,516,398
Passenger Facility Charges (Reimbursement of Pre-2018 Projects)	389,027	1,148,006	1,170,713	2,707,746	6,379,376	5,926,164
Passenger Facility Charges (2018 Forward Projects):	736,713	0	0	736,713	0	9,584,728
PFC beginning year unliquidated balance	0	0	0	0	0	0
PFC unspent current year + carryover	0	0	0	0	0	0
Other City Capital Contribution	0	0	0	0	10,000,000	0
Private 3rd Party Funding	0	0	0	0	0	4,525,365
Other Unidentified Funding	0	0	0	0	48,024,466	56,719,719
Total Other Capital Funding Sources	$13,759,027	$6,749,860	$7,443,273	$27,952,160	$105,550,782	$117,892,333
Total Funds Available for Capital Expenditures	$18,928,605	$13,303,108	$14,830,794	$35,451,685	$119,386,621	$152,263,171
Capital Improvement Program Expenditures	13,493,210	7,127,680	9,216,964	29,837,855	116,104,942	147,155,148
Ending Cash Balance	$5,435,395	$6,175,428	$5,613,830	$5,613,830	$3,281,679	$5,108,023

2015 PAVEMENT CONDITION INDEX (PCI) STUDY **EXECUTIVE SUMMARY**

www.aero.nd.gov

BISMARCK MUNICIPAL AIRPORT (BIS) BISMARCK, ND

2015 PAVEMENT CONDITION INDEX (PCI) STUDY EXECUTIVE SUMMARY

www.aero.nd.gov

FEDERAL AVIATION ADMINISTRATION
A.I.P. NO. 3-38-0000-013-2015

NORTH DAKOTA
AERONAUTICS COMMISSION
A STATEWIDE VOICE FOR AVIATION

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Overview

The Airport Pavement Management System (APMS) was developed by the Federal Aviation Administration (FAA) and is intended to provide a consistent and systematic approach to identifying pavement that is in need of maintenance or rehabilitation. The North Dakota Aeronautics Commission (NDAC) developed a customized APMS in accordance with FAA requirements.

An APMS evaluates both the current condition of the pavement as well as predicts a future condition based on the Pavement Condition Index (PCI). This in turn allows the individual airports, the NDAC and the FAA to monitor the condition of the airport pavements and budget for required maintenance to avoid excessive deterioration. The timing of this maintenance or rehabilitation is vital as airport pavement conditions play a crucial role in ensuring the safety of all airport users.

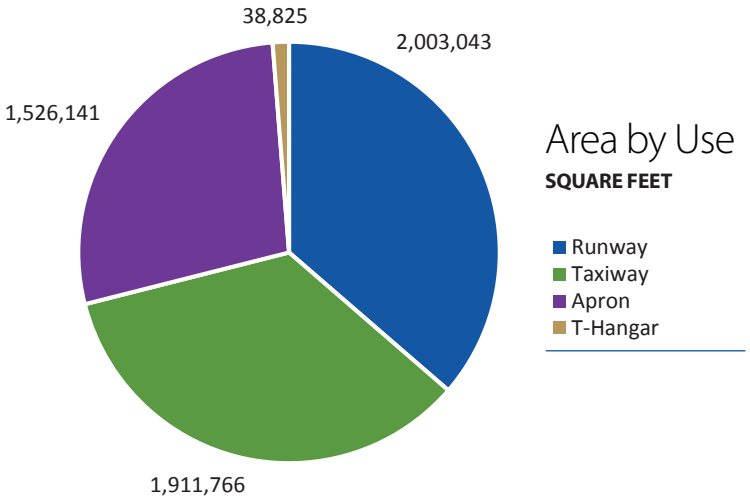
This system is updated every three years to accurately reflect current pavement conditions across the state's airports. In 2012, the APMS was updated to an electronic format to allow the data to be readily available to the airports, the FAA and the NDAC.

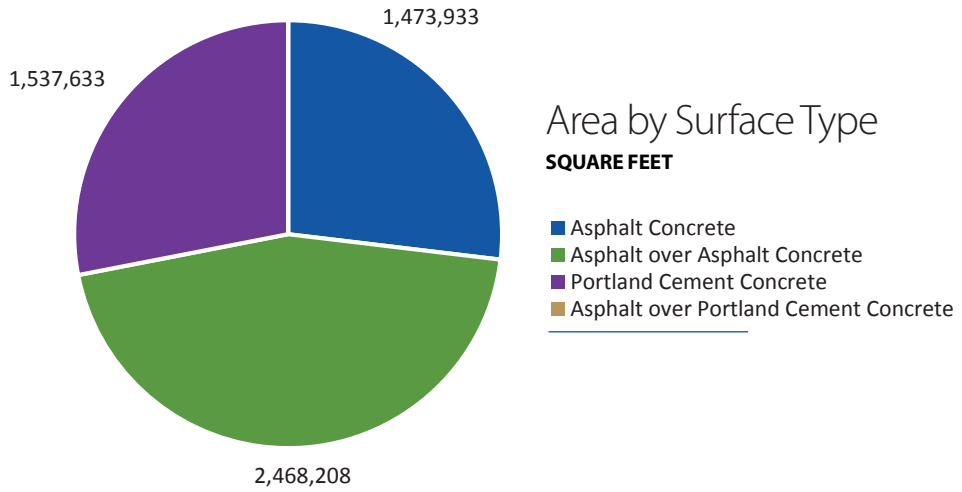
In 2015, Mead & Hunt along with Applied Pavement Technology and EVS conducted the update to the APMS. During the 2015 update, record information collected in the previous three-year cycle has been added to the database. Pavement inspections also have been completed, and additional airports have been added that were not part of the previous study. Functionality changes also have been made to the website itself. The findings and recommendations of the APMS update are included in this report. Full results can be found online on the NDAC website, **www.aero.nd.gov**.

Pavement Inventory

In 2015, a total of 71 airports were assessed for the current project. Of these, 52 were part of the National Plan of Integrated Airport Systems (NPIAS) and 19 were non-NPIAS. NPIAS airports qualify for federal funding. Non-NPIAS airports do not qualify for federal funding and must be funded solely by state and local contributions. Therefore, the FAA only provided funding for pavement inspections and reports for the NPIAS airports as part of this study. NPIAS airports inspected included 7 commercial service airports and 45 general aviation airports. Williston was not inspected as part of the 2015 study due to future relocation of the existing airport. However, Williston's 2012 pavement inventory data was used in the 2015 data analysis and is included as part of the 2015 results. Pavement inventory data includes area, age and condition. Projected costs for Williston were excluded from the funding assessment needs. A PCI of 100 was assumed for all newly constructed pavement or pavement programmed to be reconstructed in the next year.

Bismarck Municipal Airport is a commercial service, NPIAS airport. The airport consists of two paved runways, multiple parallel/connector taxiways, apron and T-hangar pavement. Pavement at the airport is comprised of 1,537,633 square feet of concrete and 3,942,141 square feet of asphalt. Throughout the years, the airport has performed preventative maintenance and carried out a series of rehabilitation/reconstruction projects to sustain and extend the pavement life. The charts below summarize the airport's pavements.



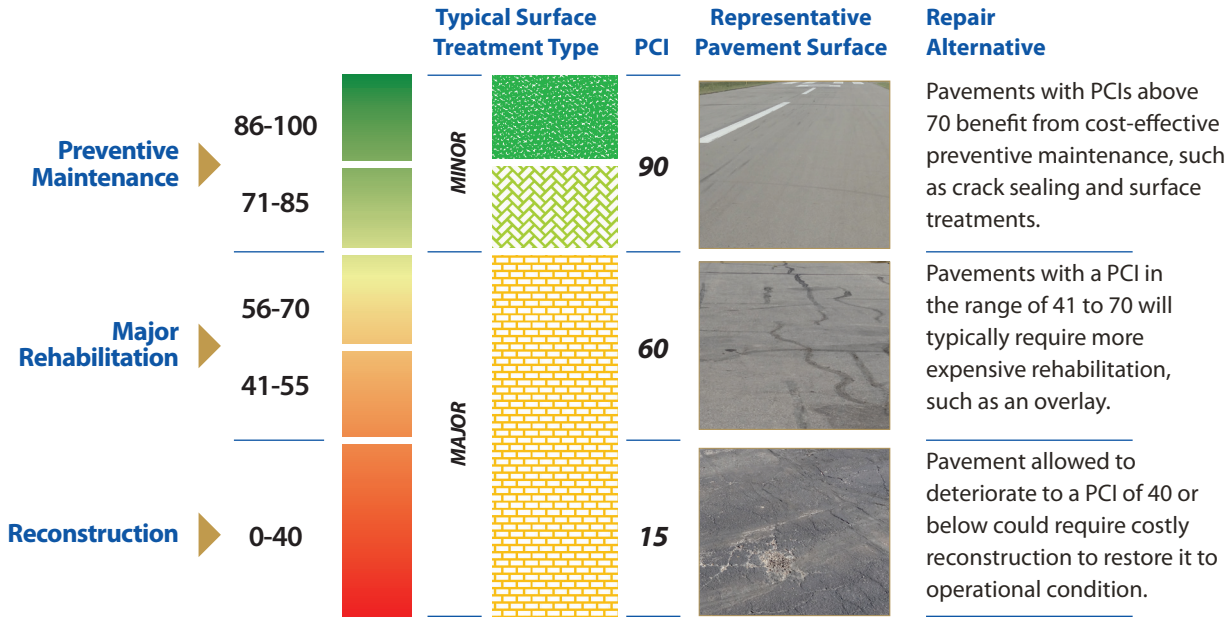


Pavement Evaluation

Pavement Evaluation Procedure

A PCI survey was conducted in accordance with the procedures outlined in American Society for Testing and Materials (ASTM) Standard D5340, *Standard Test Method for Airport Pavement Condition Index Surveys* and the FAA's Advisory Circular 150/5380-6B, *Guidelines and Procedures for Maintenance of Airport Pavements*. A PCI survey consists of dividing pavement into a series of sections, selecting random sections for sampling, and inspecting a given portion of each sample section to determine overall pavement deterioration. Pavement deterioration is based on the quantification of the different types, the severity and the number of distresses present in the sample section. This information is then used to formulate a composite index numerical value that represents the overall pavement condition. This value will range from 0 (failed) to 100 (excellent).

As part of the APMS, the PCI will be used to determine current pavement conditions, predict future conditions, develop a maintenance program and identify the most cost-effective time frame to perform major rehabilitation. The PCI will also aid in tracking and determining causes of deterioration on a pavement. The correlation between a PCI number and a recommended repair is shown in the illustration to the right. The figure also correlates the colors and hatch patterns to the PCI map found on page 10. Preventive maintenance consists of patching, crack sealing and joint sealing. Pavement rehabilitation includes surface treatments and thin overlays. Pavement reconstruction refers to full-depth reconstruction and thick overlays. Minor surface treatments are used to address weathering and low-severity raveling. Major surface treatments are used to address medium- and high-severity raveling.


Typical Surface Treatment Type
PCI
Representative Pavement Surface
Repair Alternative
Preventive Maintenance
86-100
71-85
MINOR
90
Pavements with PCIs above 70 benefit from cost-effective preventive maintenance, such as crack sealing and surface treatments.
Major Rehabilitation
56-70
41-55
MAJOR
60
Pavements with a PCI in the range of 41 to 70 will typically require more expensive rehabilitation, such as an overlay.
Reconstruction
0-40
15
Pavement allowed to deteriorate to a PCI of 40 or below could require costly reconstruction to restore it to operational condition.

Typical Distress Types

The FAA Advisory Circular provides a list of specific distresses to be analyzed and recorded when inspecting pavement. Airports in North Dakota are a combination of asphalt concrete (AC) pavement and Portland cement concrete (PCC) pavement with there being slightly more AC pavement than PCC pavement. These two pavement types have unique pavement distresses and repairs. The following is a brief description of commonly observed pavement distresses at North Dakota airports.

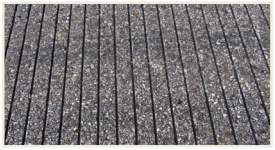
ALLIGATOR (FATIGUE) CRACKING. Alligator (fatigue) cracking is a load-related distress. Alligator cracking is caused by excessive tensile strains at the bottom of the AC layer or stabilized asphalt base layer from repeated aircraft loadings. Alligator cracking typically shows up on the surface as a series of parallel cracks, which eventually interconnect to form a pattern resembling the skin of an alligator.

JOINT SEAL DAMAGE. Joint sealant damage is any condition that enables soil or rocks to accumulate in the joints or allows significant infiltration of water. Accumulation of incompressible materials prevents the slabs from expanding and may result in buckling, shattering, or spalling. A pliable joint filler bonded to the edges of the slabs protects the joints from accumulation of materials and also prevents water from seeping down and softening the foundation supporting the slab. Typical types of joint seal damage are: (1) stripping of joint sealant, (2) extrusion of joint sealant, (3) weed growth, (4) hardening of the filler (oxidation), (5) loss of bond to the slab edges, and (6) absence of sealant in the joint.

LONGITUDINAL AND TRANSVERSE CRACKING. The predominant distress type found on asphalt pavements at North Dakota airports is longitudinal and transverse (L&T) cracking. This distress can be caused by any of the following: (1) separation of pavement at paving lane joints, (2) shrinkage of AC pavement due to temperature differentials in older or brittle pavements, or (3) reflection cracking from underlying faults in supportive layers of pavement or subgrade. Cracking is also a common distress type for PCC pavement. This distress is caused by a combination of load repetition, curling stresses, and shrinkage stresses.

RAVELING. As pavements age and are exposed to oxidation and other environmental stresses, they may experience a loss in the material making up the pavement matrix. Raveling is the dislodging and loss of coarse aggregate in the surface of a pavement. The pavement may be showing signs of aging and hardening and may result in the production of FOD.

SPALLING. Spalling, in PCC pavement, is the breakdown of the slab edges in close proximity to the slab joint. Spalling is identified as occurring in the corner or along the joint of a PCC slab. Spalling is typically caused by the introduction of incompressible material in the joint, weaker pavement at the joint caused by overworking of the pavement during construction, traffic loading or a combination of these.



WEATHERING. As pavements age and are exposed to oxidation and other environmental stresses, they may experience a loss in the material making up the pavement matrix. Weathering is the loss of asphalt binder and fine aggregate in the surface of the pavement. The loss of fine matrix material in the surface may eventually lead to the exposure and dislodging of coarse aggregate, leading to raveling and FOD.

Pavement Classification Number (PCN)

A PCN is a value that indicates the strength of a pavement as it relates to aircraft classification numbers, which are assigned to each type of aircraft. Aircraft traffic information as well as subgrade and pavement strengths are critical inputs in determining this value. Pavements at the commercial service airports were analyzed in 2012 to provide a PCN value as detailed in FAA Advisory Circular 150/5335-5B, *Standardized Methods of Reporting Airport Pavement Strength – PCN*.

The PCN is expressed as a five-part code. The first part of the PCN is a numerical value indicating the load-carrying capacity of the pavement. This numerical value is followed by four codes representing the following categories:

- **PAVEMENT TYPE**
  - **R = Rigid**
  - **F = Flexible**
- **SUBGRADE STRENGTH**
  - **A = High** (k-value ≥ 442 psi/in or CBR ≥ 13)
  - **B = Medium** (221 psi/in < k-value < 442 psi/in or 8 < CBR < 13)
  - **C = Low** (92 psi/in < k-value ≤ 221 psi/in or 4 < CBR ≤ 8)
  - **D = Ultra Low** (k-value ≤ 92 psi/in or CBR ≤ 4)
- **MAXIMUM ALLOWABLE TIRE PRESSURE**
  - **W = High** (no pressure limit)
  - **X = Medium** (146 to 218 psi)
  - **Y = Low** (74 to 145 psi)
  - **Z = Ultra Low** (pressure limited to 73 psi)
- **PAVEMENT EVALUATION METHOD**
  - **T = Technical Evaluation**
  - **U = Using Aircraft Evaluation**

PCN results were not calculated as part of the 2015 study. **The 2012 PCN results for the Bismarck Municipal Airport are listed in the table below.** A detailed PCN report can be found online on the NDAC website, www.aero.nd.gov.

2012 PCN Results

BRANCH ID	PCN
Runway 13-31	42 F/A/W/T
Runway 3-21	26 F/A/W/T

Analysis of Results

Three analyses were completed as part of this project. The first details the existing PCI values and an estimated prediction of future pavement conditions if no maintenance or repair is completed. The second applies work policies and unit costs to develop a pavement funding assessment using an unlimited budget five-year maintenance and rehabilitation (M&R) plan. Money identified in an unlimited budget scenario is to maintain or rehabilitate existing infrastructure and does not include any additional needs or improvements made. The third identifies any major M&R work recommended for runway sections beyond the current five-year plan.

Critical PCI Values

For each year of the analysis, the future condition of each of the pavements was estimated and a determination was made as to whether preventive maintenance or major rehabilitation/reconstruction was the appropriate and most cost-effective method of maintaining pavement life. If a pavement was projected to be above the critical PCI values listed below, the pavement was recommended for preventive maintenance. Major rehabilitation/reconstruction was recommended for any PCI value below the PCI critical thresholds. Surface treatments were identified for viable candidates that exhibited weathering and/or raveling. These were identified separate from the critical value analysis.

- **60 for general aviation taxiways and aprons**
- **65 for commercial service taxiways and aprons**
- **70 for general aviation runways**
- **75 for commercial service runways**

Condition Forecast Analysis

The **Bismarck Municipal Airport** was divided into multiple sample sections and an overall area-weighted pavement condition was assigned to each section. **The airport was inspected in September of 2015 and has an overall area-weighted PCI of 69, with conditions ranging from 2 to 100.**

This data is summarized on the PCI map shown on page 10. Numerous distresses were identified on the airport's pavements. Most notable distresses include but are not limited to:

- **Medium-severity weathering**
- **Low- and medium-severity L & T cracking**
- **Medium-severity raveling**

The condition forecast analysis utilized pavement performance models to estimate future conditions for the next 10-year period if no repair work is completed at the airport. The *Overall Pavement Condition* table shown provides a summary of the overall 2015 PCI values and the projected PCI values identified in each of the sections developed for the airport. In addition, the *Area-Weighted PCI by Use* chart shows the area-weighted PCI value based on the use of the pavement on the airfield.

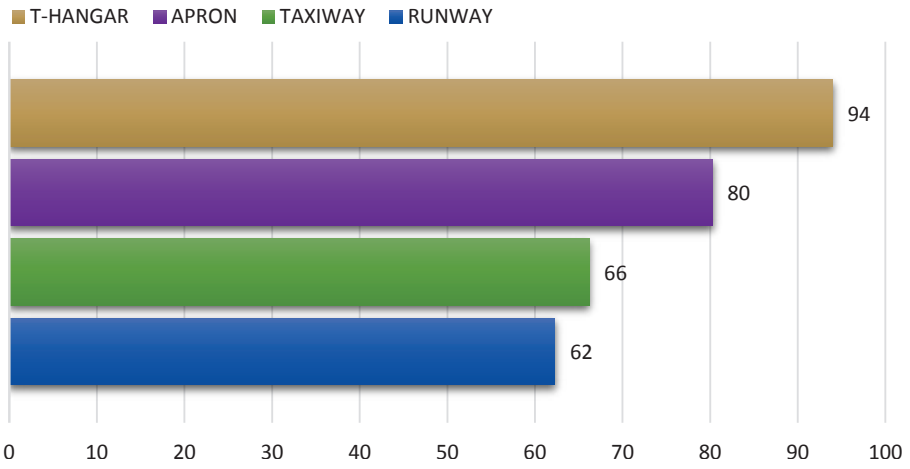
Overall Pavement Condition

BRANCH ID	SECTION ID	2015	2020	2025
AEW-BK	10	61	52	44
AGA-BK	10	100	94	87
AGA-BK	20	100	89	76
AGA-BK	35	98	91	84
AGA-BK	40	81	73	65
AGA-BK	50	98	91	84
AGA-BK	53	31	13	0
AGA-BK	54	47	38	29
AGA-BK	55	79	71	63
AGA-BK	56	88	75	61
AGA-BK	57	96	89	82
AGA-BK	63	61	52	44
AGA-BK	66	42	33	24
AGA-BK	68	61	52	44
AGA-BK	70	78	70	62
AGA-BK	75	75	67	59
ATERM-BK	25	97	90	83
ATERM-BK	30	97	90	83
ATERM-BK	35	97	90	83
ATERM-BK	40	61	45	28
ATERM-BK	45	29	10	0
ATERM-BK	5	98	91	84
ATERM-BK	55	76	68	60
ATERM-BK	60	75	67	59
ATERM-BK	65	41	23	5
RW1331-BK	10	49	39	26
RW1331-BK	15	94	83	74
RW1331-BK	25	34	21	9
RW1331-BK	30	90	80	71
RW1331-BK	35	32	19	7
RW1331-BK	40	44	32	19
RW1331-BK	45	51	42	30
RW1331-BK	47	74	66	60
RW1331-BK	5	46	34	22

BRANCH ID	SECTION ID	2015	2020	2025
RW1331-BK	50	43	30	18
RW1331-BK	55	34	21	9
RW1331-BK	57	92	81	73
RW1331-BK	60	35	22	10
RW1331-BK	65	61	47	34
RW321-BK	10	61	55	48
RW321-BK	15	82	70	56
RW321-BK	20	84	72	59
RW321-BK	25	54	46	35
RW321-BK	30	75	67	61
RW321-BK	5	73	65	59
TH-BK	5	94	83	71
TWB-BK	5	94	85	73
TWC1-BK	25	39	26	16
TWC2-BK	20	38	25	15
TWC2-BK	35	42	29	18
TWC3-BK	15	36	24	14
TWC3-BK	16	40	27	16
TWC4-BK	5	72	65	58
TWC4-BK	95	37	24	14
TWC5-BK	25	57	50	41
TWC-BK	10	72	65	58
TWC-BK	15	72	65	58
TWC-BK	20	65	59	52
TWC-BK	30	40	27	16
TWC-BK	35	79	66	53
TWC-BK	40	39	26	16
TWD1-BK	10	69	62	56
TWD2-BK	5	71	64	58
TWD-BK	10	75	67	61
TWD-BK	11	76	63	49

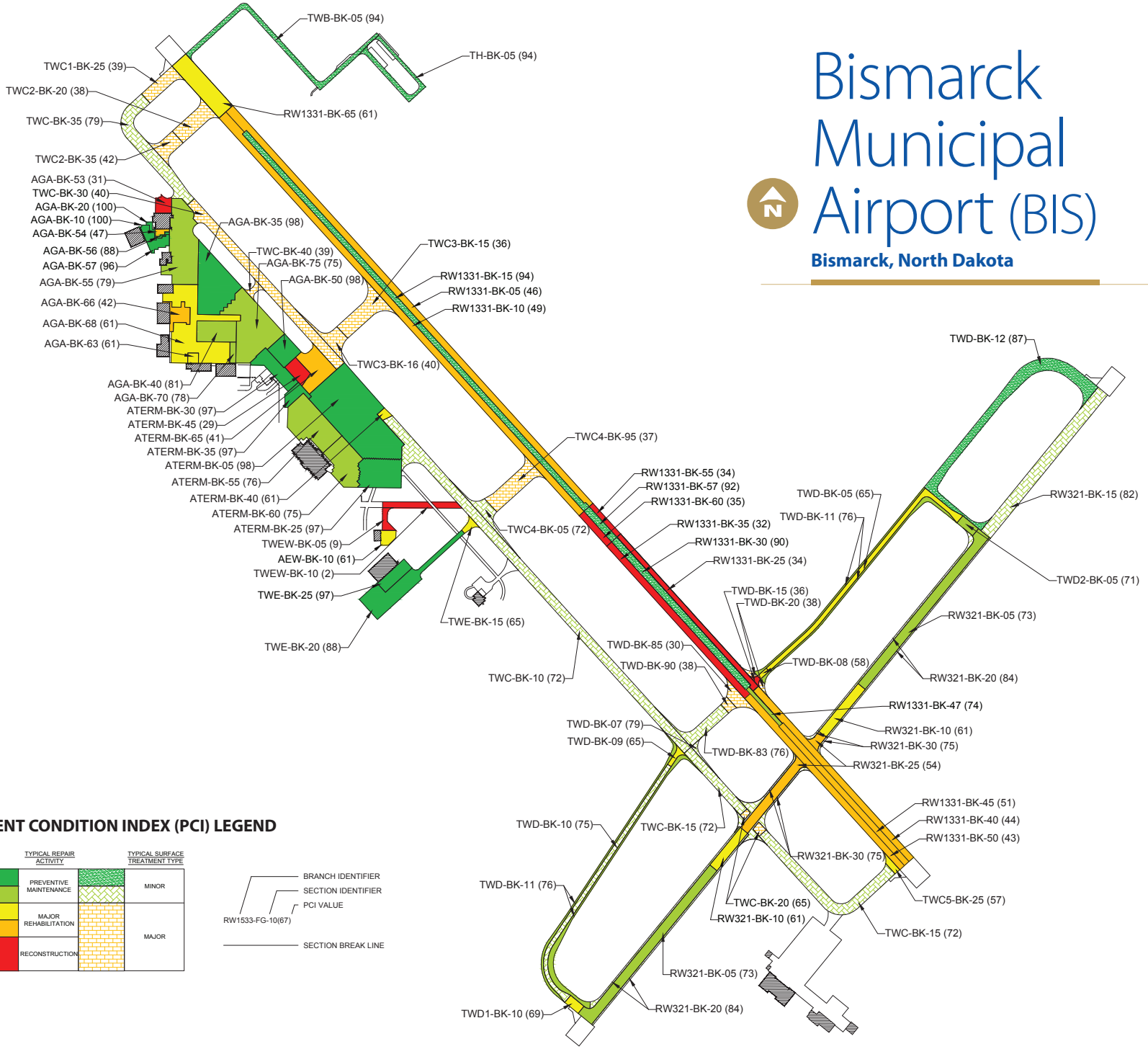
BRANCH ID	SECTION ID	2015	2020	2025
TWD-BK	12	87	75	63
TWD-BK	15	36	23	11
TWD-BK	20	38	25	13
TWD-BK	5	65	59	52
TWD-BK	7	79	70	63
TWD-BK	8	58	51	43
TWD-BK	83	76	68	61
TWD-BK	85	30	17	5
TWD-BK	9	65	59	52
TWD-BK	90	38	25	13
TWE-BK	15	65	51	38
TWE-BK	20	88	84	80
TWE-BK	25	97	93	89
TWEW-BK	10	2	0	0
TWEW-BK	5	9	0	0

Area-Weighted PCI by Use

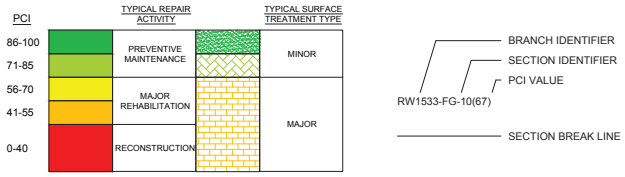


Bismarck Municipal Airport (BIS)

Bismarck, North Dakota



PAVEMENT CONDITION INDEX (PCI) LEGEND



Get *Your* Airport's Pavement Distress Level

For information on pavement distresses specific to your airport, visit the Interactive Data Exchange Application (IDEA) website by going to www.aero.nd.gov and navigating to "Studies" then "Pavement Condition Index" then "Click Here." Once there, you can view a list of the distresses that were identified as well as a maintenance and rehabilitation plan. The IDEA site also contains photos of your airport along with an interactive version of your PCI map.

Pavement Funding Assessment

Funding for aviation projects within the state is crucial in order to maintain a steady pavement condition and ensure safety of all aviation users. If no funding is provided for pavement maintenance and repair, North Dakota's pavement system will experience a slow and steady decline in condition. This decline would result in a need for more major rehabilitation or reconstruction projects, which in turn significantly increases future cost.

Using the information collected during the pavement inspection, a rehabilitation program for 2016 through 2020 was developed for Bismarck Municipal Airport. A five-year program was prepared with the goal of maintaining the pavement above the established critical PCI values listed earlier in this report. The program generates a major rehabilitation recommendation for pavement in the year they drop below their critical PCI.

For the first year of the analysis only, a localized preventive maintenance plan was developed for the pavement sections that were above their critical PCI and where the distress types present were viable candidates for this type of repair. As the pavements age, the amount of localized maintenance required will increase. The NDAC recommends that the airport anticipate performing maintenance activities as the pavements age and use the 2016 maintenance plan as a baseline for that work. The PCI value of pavements displaying large quantities of weathering and raveling can be increased significantly by applying a surface treatment. This type of repair has been identified where applicable.

The unlimited budget funding needs through 2020 for the Bismarck Municipal Airport are summarized in the table that follows. This analysis is for 2016 through 2020 with an inflation factor of four percent when calculating future cost of work. The unit costs used to estimate overall project costs are based on averages of recent projects completed throughout the state. These costs are averages and are not intended to be used for specific project planning purposes.

Five-Year Funding Plan

PLANNED WORK YEAR	BRANCH ID	SECTION ID	PROJECTED PCI BEFORE WORK	PROJECTED PCI AFTER WORK	PREVENTIVE MAINTENANCE COST	SURFACE TREATMENT COST	MAJOR M&R COST	ESTIMATED TOTAL COST
2016	AEW-BK	10	61	100	$0	$0	$138,277	$138,277
2016	AGA-BK	35	98	99	$2,056	$0	$0	$2,056
2016	AGA-BK	40	81	81	$7,743	$0	$0	$7,743
2016	AGA-BK	53	30	100	$0	$0	$196,595	$196,595
2016	AGA-BK	54	47	100	$0	$0	$65,531	$65,531
2016	AGA-BK	55	79	82	$4,618	$0	$0	$4,618
2016	AGA-BK	57	96	99	$3,802	$0	$0	$3,802
2016	AGA-BK	63	61	100	$0	$0	$76,165	$76,165
2016	AGA-BK	66	42	100	$0	$0	$383,281	$383,281
2016	AGA-BK	68	61	100	$0	$0	$1,831,725	$1,831,725

PLANNED WORK YEAR	BRANCH ID	SECTION ID	PROJECTED PCI BEFORE WORK	PROJECTED PCI AFTER WORK	PREVENTIVE MAINTENANCE COST	SURFACE TREATMENT COST	MAJOR M&R COST	ESTIMATED TOTAL COST
2016	AGA-BK	75	75	80	$18,595	$0	$0	$18,595
2016	ATERM-BK	40	60	100	$0	$0	$50,103	$50,103
2016	ATERM-BK	45	28	100	$0	$0	$270,569	$270,569
2016	ATERM-BK	55	76	80	$77,644	$0	$0	$77,644
2016	ATERM-BK	60	75	80	$75,177	$0	$0	$75,177
2016	ATERM-BK	65	40	100	$0	$0	$723,599	$723,599
2016	RW1331-BK	5	45	100	$0	$0	$2,269,309	$2,269,309
2016	RW1331-BK	10	49	100	$0	$0	$2,021,952	$2,021,952
2016	RW1331-BK	15	94	99	$0	$144,014	$0	$144,014
2016	RW1331-BK	25	33	100	$0	$0	$792,350	$792,350
2016	RW1331-BK	30	90	96	$0	$73,109	$0	$73,109
2016	RW1331-BK	35	31	100	$0	$0	$1,036,627	$1,036,627
2016	RW1331-BK	40	43	100	$0	$0	$1,015,844	$1,015,844
2016	RW1331-BK	45	51	100	$0	$0	$598,767	$598,767
2016	RW1331-BK	47	74	100	$0	$0	$54,909	$54,909
2016	RW1331-BK	50	42	100	$0	$0	$1,068,356	$1,068,356
2016	RW1331-BK	55	33	100	$0	$0	$156,009	$156,009
2016	RW1331-BK	57	92	98	$0	$15,127	$0	$15,127
2016	RW1331-BK	60	34	100	$0	$0	$207,480	$207,480
2016	RW1331-BK	65	60	100	$0	$0	$678,570	$678,570
2016	RW321-BK	5	73	100	$0	$0	$1,076,654	$1,076,654
2016	RW321-BK	10	61	100	$0	$0	$523,228	$523,228
2016	RW321-BK	15	82	90	$961	$117,234	$0	$118,195
2016	RW321-BK	20	84	94	$1,341	$81,666	$0	$83,007
2016	RW321-BK	25	54	100	$0	$0	$534,762	$534,762
2016	RW321-BK	30	75	93	$1,095	$92,531	$0	$93,626
2016	TH-BK	5	94	100	$0	$30,284	$0	$30,284
2016	TWB-BK	5	94	100	$0	$59,145	$0	$59,145
2016	TWC1-BK	25	39	91	$1,120	$55,084	$0	$56,204
2016	TWC2-BK	20	38	94	$1,035	$74,825	$0	$75,860
2016	TWC2-BK	35	42	97	$0	$47,248	$0	$47,248

Five-Year Funding Plan (continued)

PLANNED WORK YEAR	BRANCH ID	SECTION ID	PROJECTED PCI BEFORE WORK	PROJECTED PCI AFTER WORK	PREVENTIVE MAINTENANCE COST	SURFACE TREATMENT COST	MAJOR M&R COST	ESTIMATED TOTAL COST
2016	TWC3-BK	15	36	91	$1,969	$101,412	$0	$103,381
2016	TWC3-BK	16	40	96	$445	$47,870	$0	$48,315
2016	TWC4-BK	5	72	92	$671	$21,226	$0	$21,897
2016	TWC4-BK	95	37	80	$6,714	$102,211	$0	$108,925
2016	TWC5-BK	25	57	100	$0	$0	$59,490	$59,490
2016	TWC-BK	10	72	88	$3,625	$230,501	$0	$234,126
2016	TWC-BK	15	72	90	$4,085	$135,880	$0	$139,965
2016	TWC-BK	20	65	81	$526	$7,644	$0	$8,170
2016	TWC-BK	30	40	92	$0	$227,478	$0	$227,478
2016	TWC-BK	35	79	99	$0	$84,962	$0	$84,962
2016	TWC-BK	40	39	95	$133	$12,714	$0	$12,847
2016	TWD1-BK	10	69	78	$554	$0	$0	$554
2016	TWD2-BK	5	71	78	$649	$0	$0	$649
2016	TWD-BK	5	65	100	$0	$0	$525,250	$525,250
2016	TWD-BK	7	79	93	$158	$4,448	$0	$4,606
2016	TWD-BK	8	58	100	$0	$0	$26,807	$26,807
2016	TWD-BK	9	65	100	$0	$0	$44,889	$44,889
2016	TWD-BK	10	75	80	$1,916	$62,993	$0	$64,909
2016	TWD-BK	11	75	100	$0	$0	$681,671	$681,671
2016	TWD-BK	12	87	90	$759	$132,413	$0	$133,172
2016	TWD-BK	15	35	100	$0	$0	$35,073	$35,073
2016	TWD-BK	20	38	87	$433	$11,326	$0	$11,759
2016	TWD-BK	83	76	91	$1,467	$33,735	$0	$35,202
2016	TWD-BK	85	30	82	$655	$32,760	$0	$33,415
2016	TWD-BK	90	38	85	$545	$12,137	$0	$12,682
2016	TWE-BK	15	65	97	$0	$11,513	$0	$11,513
2016	TWE-BK	20	88	94	$83,636	$0	$0	$83,636
2016	TWEW-BK	5	9	100	$0	$0	$122,567	$122,567
2016	TWEW-BK	10	2	100	$0	$0	$341,636	$341,636
2016 Total					**$304,127**	**$2,063,490**	**$17,608,045**	**$19,975,662**

PLANNED WORK YEAR	BRANCH ID	SECTION ID	PROJECTED PCI BEFORE WORK	PROJECTED PCI AFTER WORK	PREVENTIVE MAINTENANCE COST	SURFACE TREATMENT COST	MAJOR M&R COST	ESTIMATED TOTAL COST
2017								No work identified for 2017
2017 Total					**$0**	**$0**	**$0**	**$0**
2018								No work identified for 2018
2018 Total					**$0**	**$0**	**$0**	**$0**
2019	TWD1-BK	10	64	100	$0	$0	$75,238	$75,238
2019 Total					**$0**	**$0**	**$75,238**	**$75,238**
2020	TWD2-BK	5	65	100	$0	$0	$90,419	$90,419
2020 Total					**$0**	**$0**	**$90,419**	**$90,419**
Five-Year Plan Total					**$304,127**	**$2,063,490**	**$17,773,702**	**$20,141,319**

Future Runway Needs

A future runway needs analysis was conducted to help the state plan for major runway repair or reconstruction projects that are anticipated post 2020. The results provide an indication of the timing of future runway needs by applying an averaged deterioration rate developed from similar pavements throughout the state. Therefore, in addition to the five-year funding plan, the following table details all anticipated runway pavement needs post 2020.

PLANNED WORK YEAR	BRANCH ID	SECTION ID	PROJECTED PCI BEFORE WORK	PROJECTED PCI AFTER WORK	PREVENTIVE MAINTENANCE COST	MAJOR M&R COST	ESTIMATED TOTAL COST
2021	RW321-BK	15	69	100	$0	$700,001	$700,001
2021	RW321-BK	20	71	100	$0	$453,351	$453,351
2021	RW321-BK	30	67	100	$0	$245,084	$245,084
2021 Total					**$0**	**$1,398,436**	**$1,398,436**
2024	RW1331-BK	30	74	100	$0	$456,522	$456,522
2024 Total					**$0**	**$456,522**	**$456,522**
2025	RW1331-BK	57	74	100	$0	$98,240	$98,240
2025 Total					**$0**	**$98,240**	**$98,240**
2026	RW1331-BK	15	74	100	$0	$972,666	$972,666
2026 Total					**$0**	**$972,666**	**$972,666**

Summary

This report summarizes the results of the pavement evaluation conducted at Bismarck Municipal Airport. The airport is a commercial service, NPIAS airport. **In 2012, the PCI value for the airport was 78. During a visual inspection of the pavement in 2015, it was found that the current weighted PCI of the pavement network is 69.** If all the work identified at the airport were to be completed on existing pavements as shown in the Pavement Funding Assessment section of this report, approximately $20.1 million in funding would be needed over the next five years to maintain the pavement above their critical PCI levels. Additional information can be found by visiting the NDAC website, **www.aero.nd.gov**.

BISMARCK MUNICIPAL AIRPORT (BIS) BISMARCK, ND

NORTH DAKOTA AERONAUTICS COMMISSION

FOR ADDITIONAL INFORMATION, PLEASE VISIT

WWW.AERO.ND.GOV

NORTH DAKOTA

AERONAUTICS COMMISSION

A STATEWIDE VOICE FOR AVIATION

LOC I-BZX	APP CRS	Rwy Idg	8794
111.5	131°	TDZE	1655
		Apt Elev	1661

ILS or LOC RWY 13

BISMARCK MUNI (BIS)

DME required for procedure entry. DME required.

ASR

-35°C

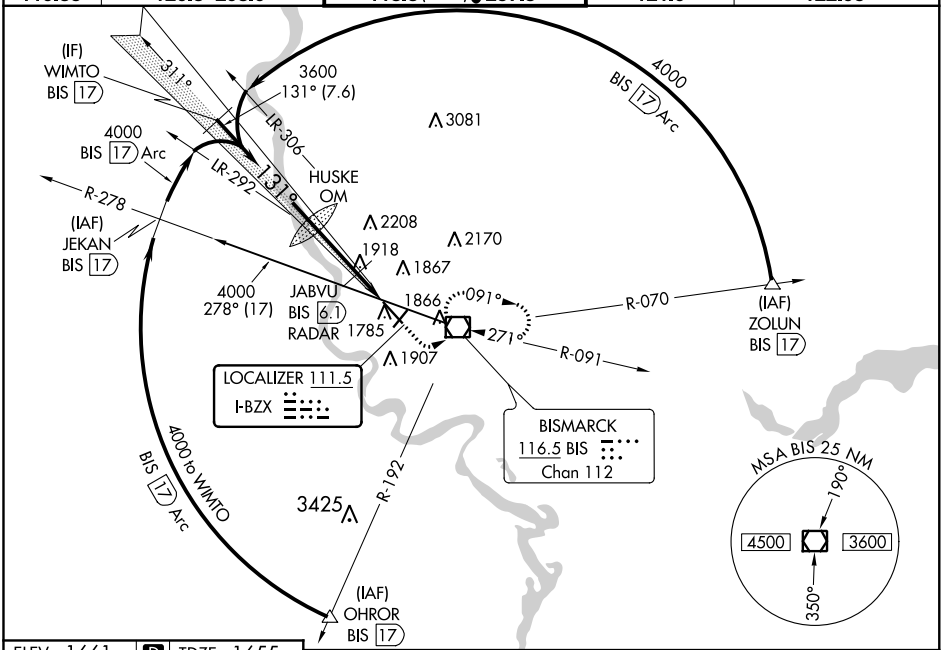
Inop table does not apply to S-ILS 13. DME from BIS VOR/DME. Simultaneous reception of I-BZX and BIS DME required.

DME from BIS VOR/DME.

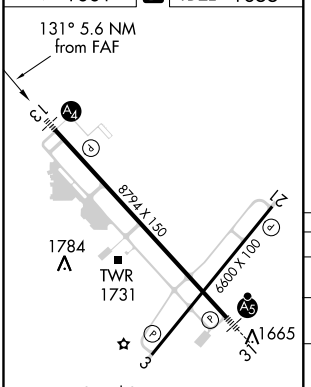
MALS

MISSED APPROACH: Climb to 2200 then climbing left turn to 3600 direct BIS VOR/DME and hold, continue climb-in-hold to 3600.

ATIS	BISMARCK APP CON ★	BISMARCK TOWER ★	GND CON	UNICOM
119.35	126.3 298.9	118.3 (CTAF) L 257.8	121.9	122.95

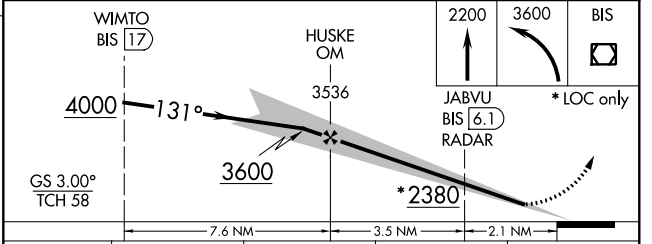


ELEV 1661 D TDZE 1655



REIL Rwys 3 and 21
HIRL Rwys 3-21 and 13-31

FAF to MAP 5.6 NM					
Knots	60	90	120	150	180
Min:Sec	5:36	3:44	2:48	2:14	1:52



CATEGORY	A	B	C	D
S-ILS 13	1855-¾ 200 (200-¾)			
S-LOC 13	2380-¾ 725 (800-¾)		2380-1¾ 725 (800-1¾)	
CIRCLING	2380-1 719 (800-1)		2460-2¼ 799 (800-2¼)	2460-2½ 799 (800-2½)
# JABVU FIX MINIMUMS				
S-LOC 13	2180-¾ 525 (600-¾)		2180-1¼ 525 (600-1¼)	
CIRCLING	2240-1 579 (600-1)		2460-2¼ 799 (800-2¼)	2460-2½ 799 (800-2½)

NC-1, 28 MAR 2019 to 25 APR 2019
NC-1, 28 MAR 2019 to 25 APR 2019

LOC/DME I-BIS	APP CRS	Rwy Idg	8794
110.3	311°	TDZE	1645
Chan 40		Apt Elev	1661

ILS or LOC RWY 31
BISMARCK MUNI (BIS)

DME required for procedure entry.

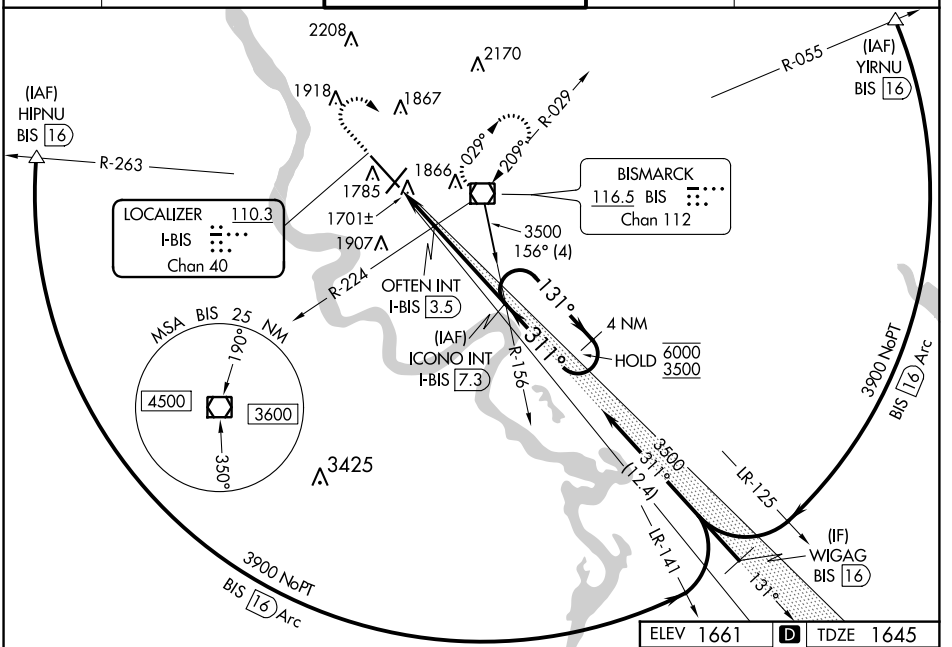
ASR -35°C

Autopilot coupled approach NA below 2680.
For inop ALS, increase S-LOC 31 OFTEN FIX Cat C/D minimums visibility to RVR 5500.

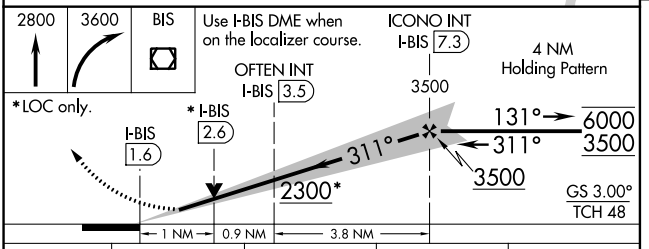
MALSR

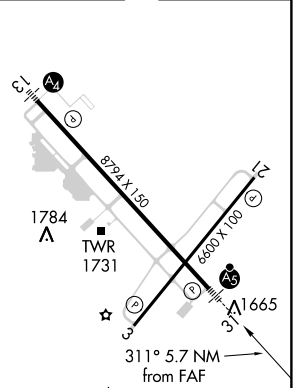
MISSED APPROACH: Climb to 2800 then climbing right turn to 3600 direct BIS VOR/DME and hold.

ATIS	BISMARCK APP CON★	BISMARCK TOWER★	GND CON	UNICOM
119.35	126.3 298.9	118.3 (CTAF) L 257.8	121.9	122.95



ELEV 1661 D TDZE 1645





CATEGORY	A	B	C	D
S-ILS 31	1845/24 200 (200-½)			
S-LOC 31	2300/24 655 (700-½)		2300-1⅜ 655 (700-1⅜)	
C CIRCLING	2300-1 639 (700-1)		2460-2¼ 799 (800-2¼)	2460-2½ 799 (800-2½)
OFTEN FIX MINIMUMS (DUAL VOR RECEIVERS OR DME REQUIRED)				
S-LOC 31	2020/24 375 (400-½)		2020/35 375 (400-⅝)	
C CIRCLING	2240-1 579 (600-1)		2460-2¼ 799 (800-2¼)	2460-2½ 799 (800-2½)

REIL Rwys 3 and 21
HIRL Rwys 3-21 and 13-31

FAF to MAP 5.7 NM					
Knots	60	90	120	150	180
Min:Sec	5:42	3:48	2:51	2:17	1:54

NC-1, 28 MAR 2019 to 25 APR 2019
NC-1, 28 MAR 2019 to 25 APR 2019

RNAV (GPS) RWY 3

BISMARCK MUNI (BIS)

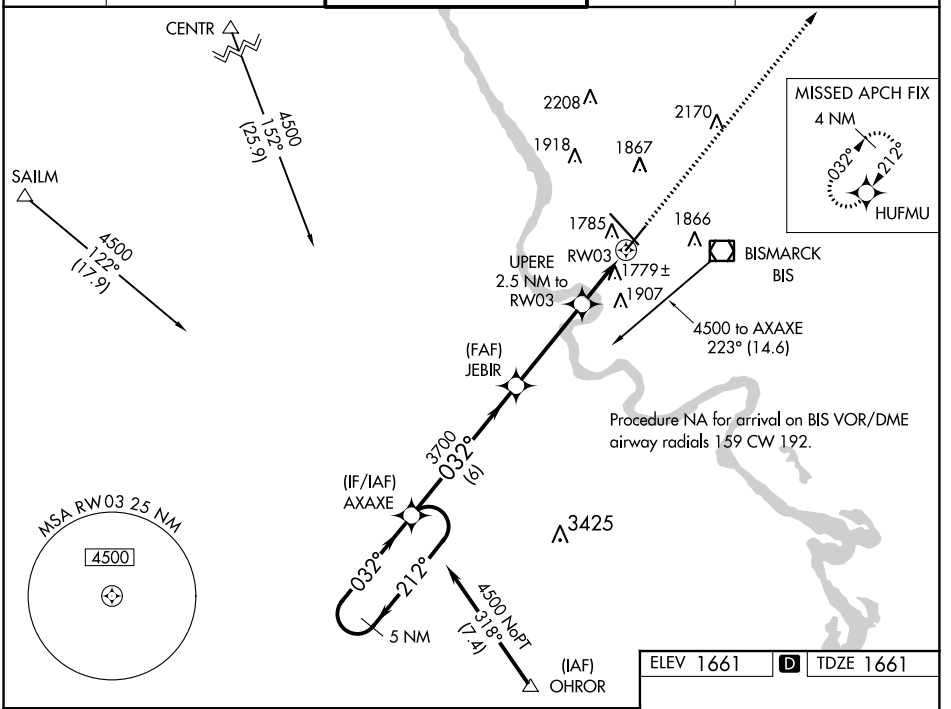
WAAS	APP CRS	Rwy Idg	6600
CH 63099	032°	TDZE	1661
W03A		Apt Elev	1661

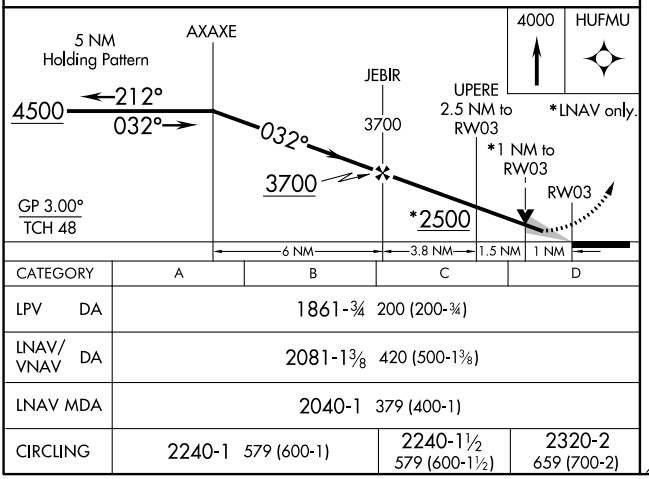
ASR
-35°C

For uncompensated Baro-VNAV systems, LNAV/VNAV NA below -18°C (0°F) or above 33°C (91°F). DME/DME RNP-0.3 NA.

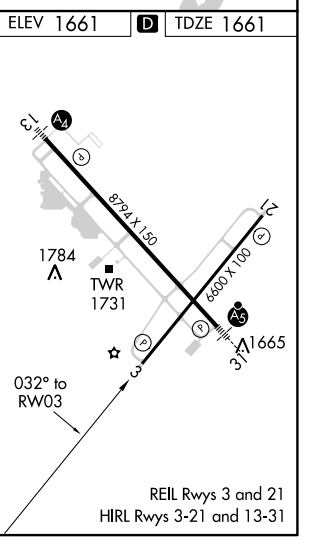
MISSED APPROACH: Climb to 4000 direct HUFMU and hold.

ATIS	BISMARCK APP CON	BISMARCK TOWER	GND CON	UNICOM
119.35	126.3 298.9	118.3 (CTAF) L 257.8	121.9	122.95





CATEGORY	A	B	C	D
LPV DA	1861-¾ 200 (200-¾)			
LNAV/VNAV DA	2081-1⅜ 420 (500-1⅜)			
LNAV MDA	2040-1 379 (400-1)			
CIRCLING	2240-1 579 (600-1)		2240-1½ 579 (600-1½)	2320-2 659 (700-2)



NC-1, 28 MAR 2019 to 25 APR 2019
NC-1, 28 MAR 2019 to 25 APR 2019

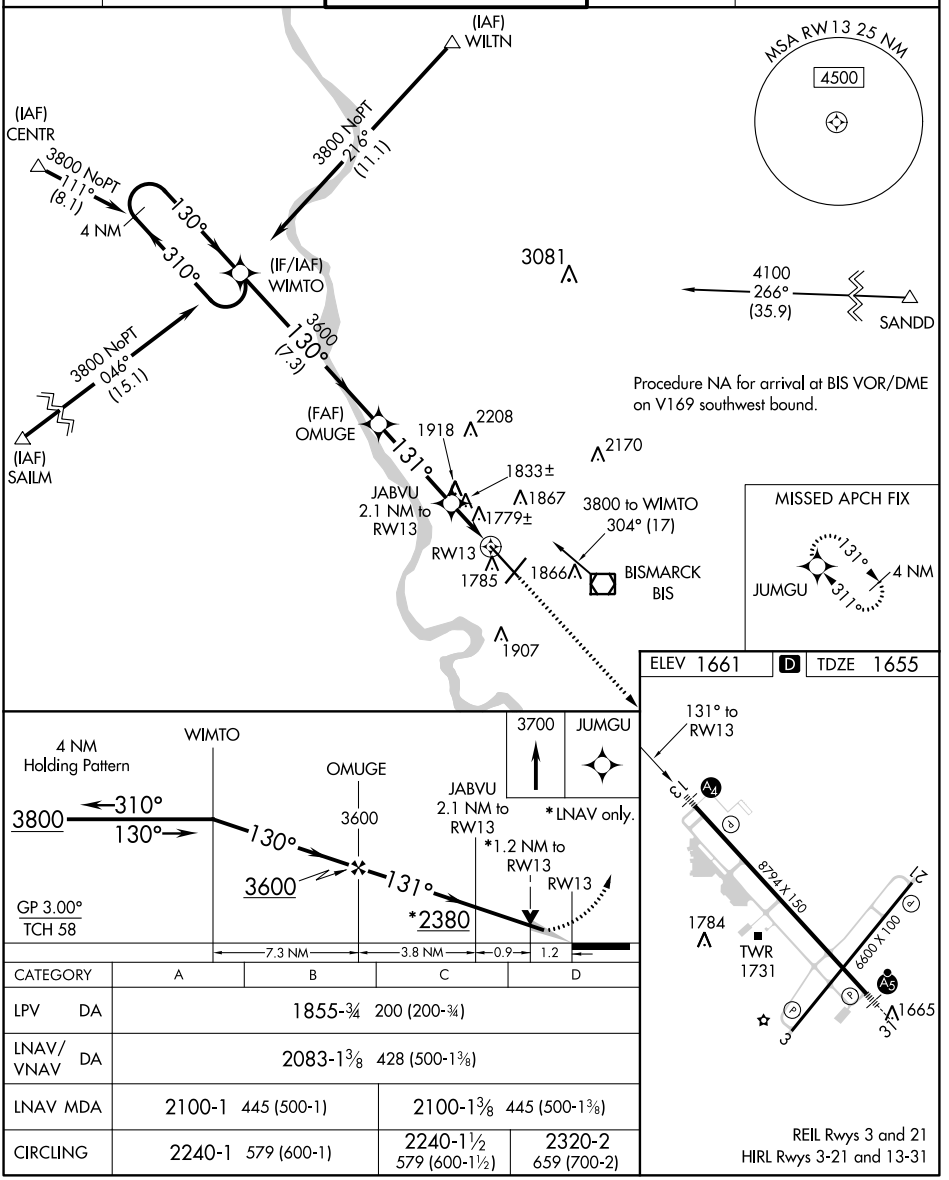
WAAS	APP CRS	Rwy Idg	8794
CH 86920	131°	TDZE	1655
W13A		Apt Elev	1661

RNAV (GPS) RWY 13

BISMARCK MUNI (BIS)

ASR	Inoperative table does not apply. For uncompensated Baro-VNAV systems, LNAV/VNAV NA below -18°C (0°F) or above 33°C (91°F).DME/DME RNP-0.3 NA.	MALS	MISSED APPROACH: Climb to 3700 direct JUMGU and hold.
-35°C			

ATIS	BISMARCK APP CON	BISMARCK TOWER	GND CON	UNICOM
119.35	126.3 298.9	118.3 (CTAF) 257.8	121.9	122.95



CATEGORY	A	B	C	D
LPV DA	1855-¾ 200 (200-¾)			
LNAV/ VNAV DA	2083-1⅜ 428 (500-1⅜)			
LNAV MDA	2100-1 445 (500-1)		2100-1⅜ 445 (500-1⅜)	
CIRCLING	2240-1 579 (600-1)		2240-1½ 579 (600-1½)	2320-2 659 (700-2)

REIL Rwys 3 and 21
HIRL Rwys 3-21 and 13-31

NC-1, 28 MAR 2019 to 25 APR 2019
NC-1, 28 MAR 2019 to 25 APR 2019

RNAV (GPS) RWY 21

BISMARCK MUNI (BIS)

WAAS	APP CRS	Rwy Idg	6600
CH 53520	212°	TDZE	1661
W21A		Apt Elev	1661

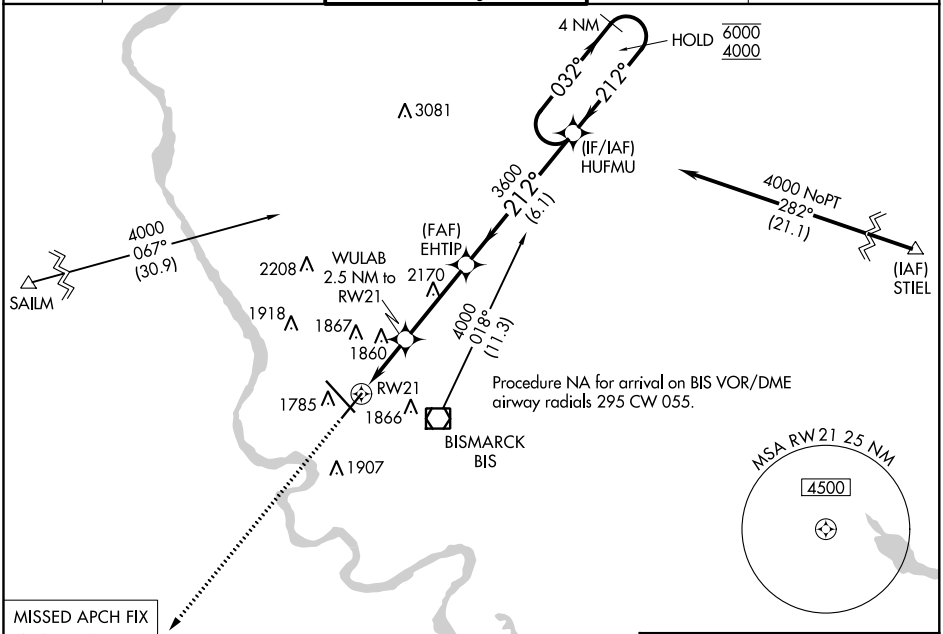
RNP APCH.

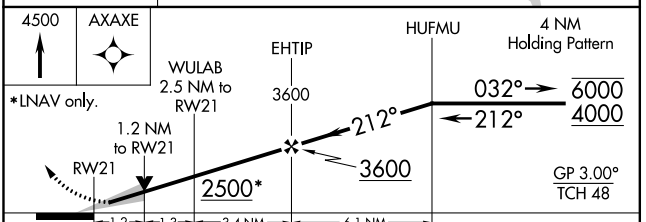
V A ASR -35°C

For uncompensated Baro-VNAV systems, LNAV/VNAV NA below -22°C or above 54°C.

MISSED APPROACH: Climb to 4500 direct AXAXE and hold.

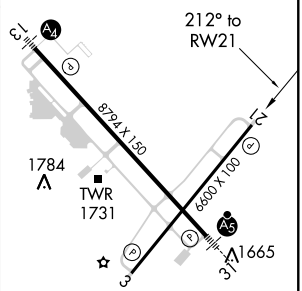
ATIS	BISMARCK APP CON★	BISMARCK TOWER★	GND CON	UNICOM
119.35	126.3 298.9	118.3 (CTAF) L 257.8	121.9	122.95





CATEGORY	A	B	C	D
LPV DA	1861-¾	200 (200-¾)		
LNAV/VNAV DA	1970-⅞	309 (400-⅞)		
LNAV MDA	2100-1 439 (500-1)		2100-1¼ 439 (500-1¼)	
C CIRCLING	2200-1 539 (600-1)		2460-2¼ 799 (800-2¼)	2460-2½ 799 (800-2½)

ELEV 1661 D TDZE 1661



REIL Rwys 3 and 21
HIRL Rwys 3-21 and 13-31

NC-1, 28 MAR 2019 to 25 APR 2019
NC-1, 28 MAR 2019 to 25 APR 2019

RNAV (GPS) RWY 31

BISMARCK MUNI (BIS)

WAAS CH 56599 W31A	APP CRS 311°	Rwy Idg 8794 TDZE 1645 Apt Elev 1661

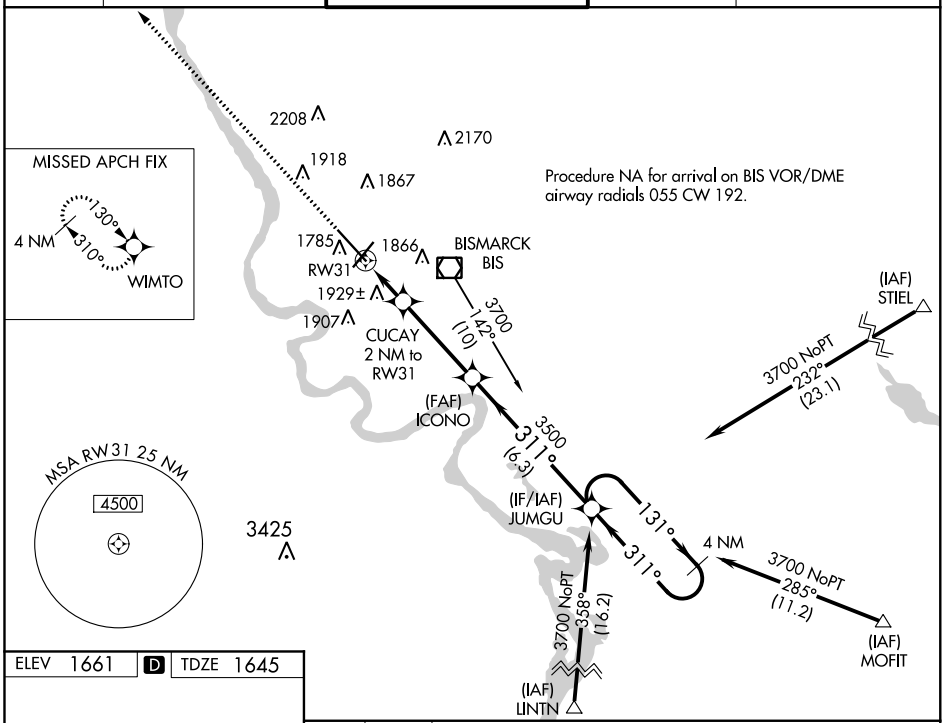
ASR -35°C

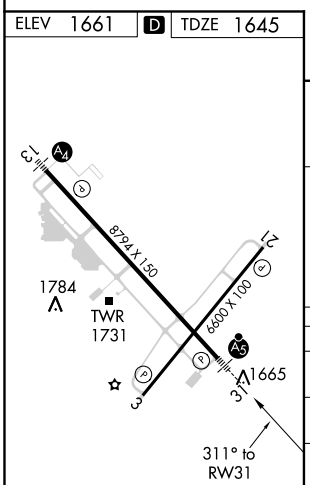
For uncompensated Baro-VNAV systems, LNAV/VNAV NA below -18°C (0°F) or above 33°C (91°F). DME/DME RNP-0.3 NA. ** RVR 1800 authorized with use of FD or AP or HUD to DA.

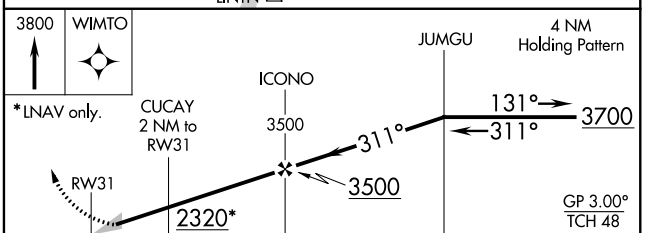
MALSR

MISSED APPROACH: Climb to 3800 direct WIMTO and hold.

ATIS	BISMARCK APP CON★	BISMARCK TOWER★	GND CON	UNICOM
119.35	126.3 298.9	118.3 (CTAF) L 257.8	121.9	122.95







CATEGORY	A	B	C	D
LPV DA	1845/24 200 (200-½)			
LNAV/VNAV DA	2269-1¾ 624 (700-1¾)			
LNAV MDA	2180/24 535 (600-½)		2180/55 535 (600-1)	
CIRCLING	2240-1 579 (600-1)		2240-1½ 579 (600-1½)	2320-2 659 (700-2)

NC-1, 28 MAR 2019 to 25 APR 2019
NC-1, 28 MAR 2019 to 25 APR 2019

VOR/DME BIS	APP CRS	Rwy Idg	N/A
116.5	271°	TDZE	N/A
Chan 112		Apt Elev	1661

VOR-A

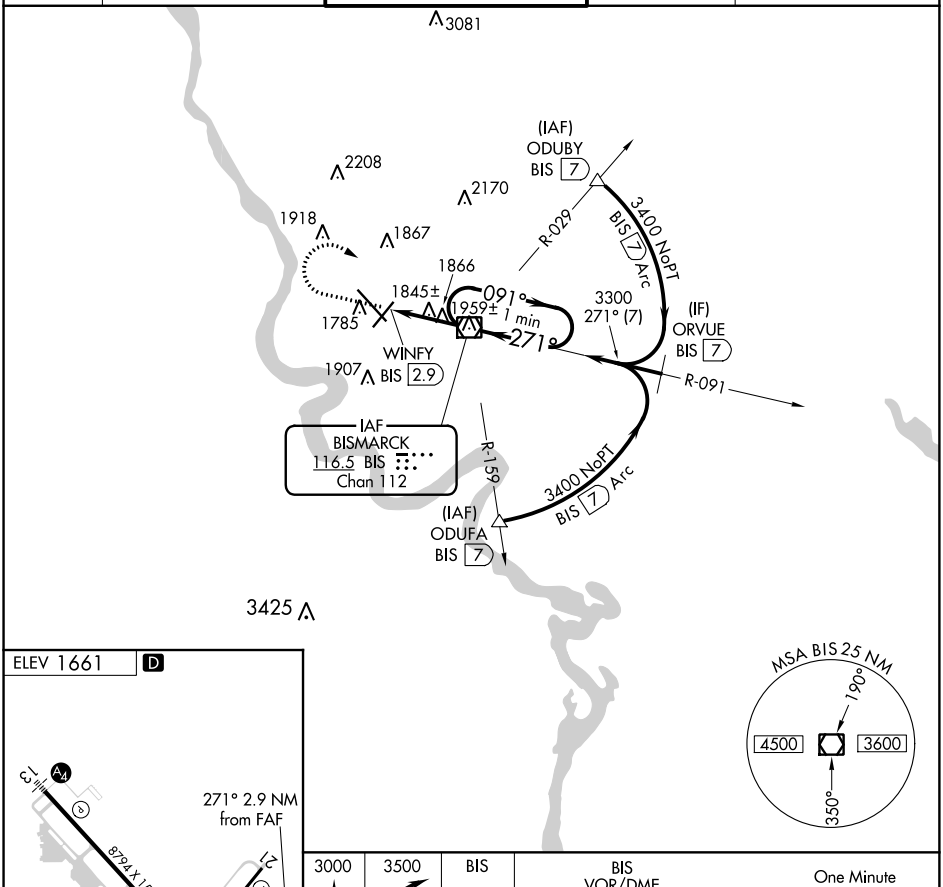
BISMARCK MUNI (BIS)

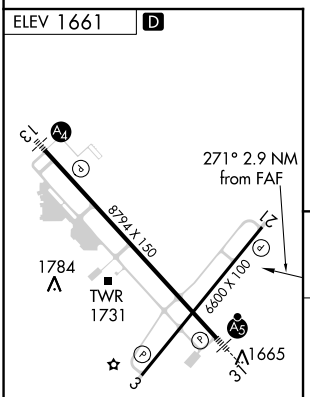
ASR

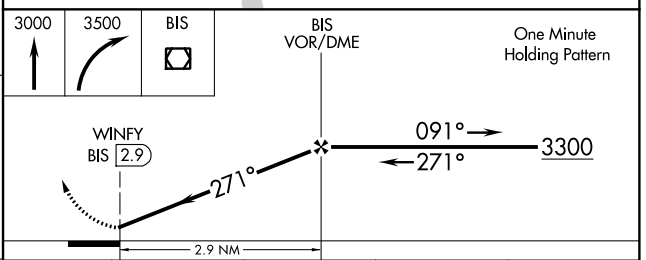
-35°C

MISSED APPROACH: Climb to 3000 then climbing right turn to 3500 direct BIS VOR/DME and hold.

ATIS	BISMARCK APP CON ★	BISMARCK TOWER ★	GND CON	UNICOM
119.35	126.3 298.9	118.3 (CTAF) 257.8	121.9	122.95



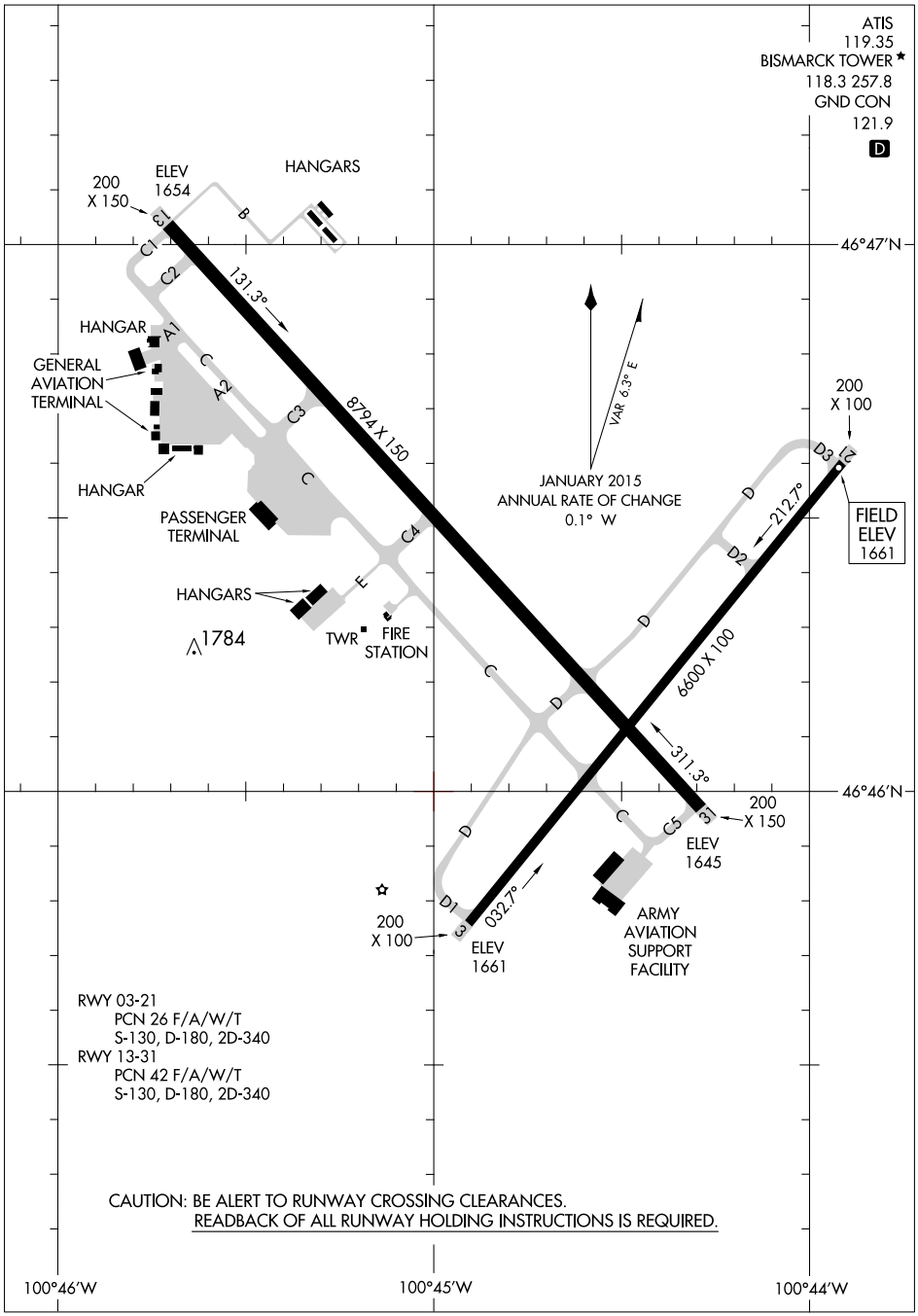




FAF to MAP 2.9 NM					
Knots	60	90	120	150	180
Min:Sec	2:54	1:56	1:27	1:10	0:58

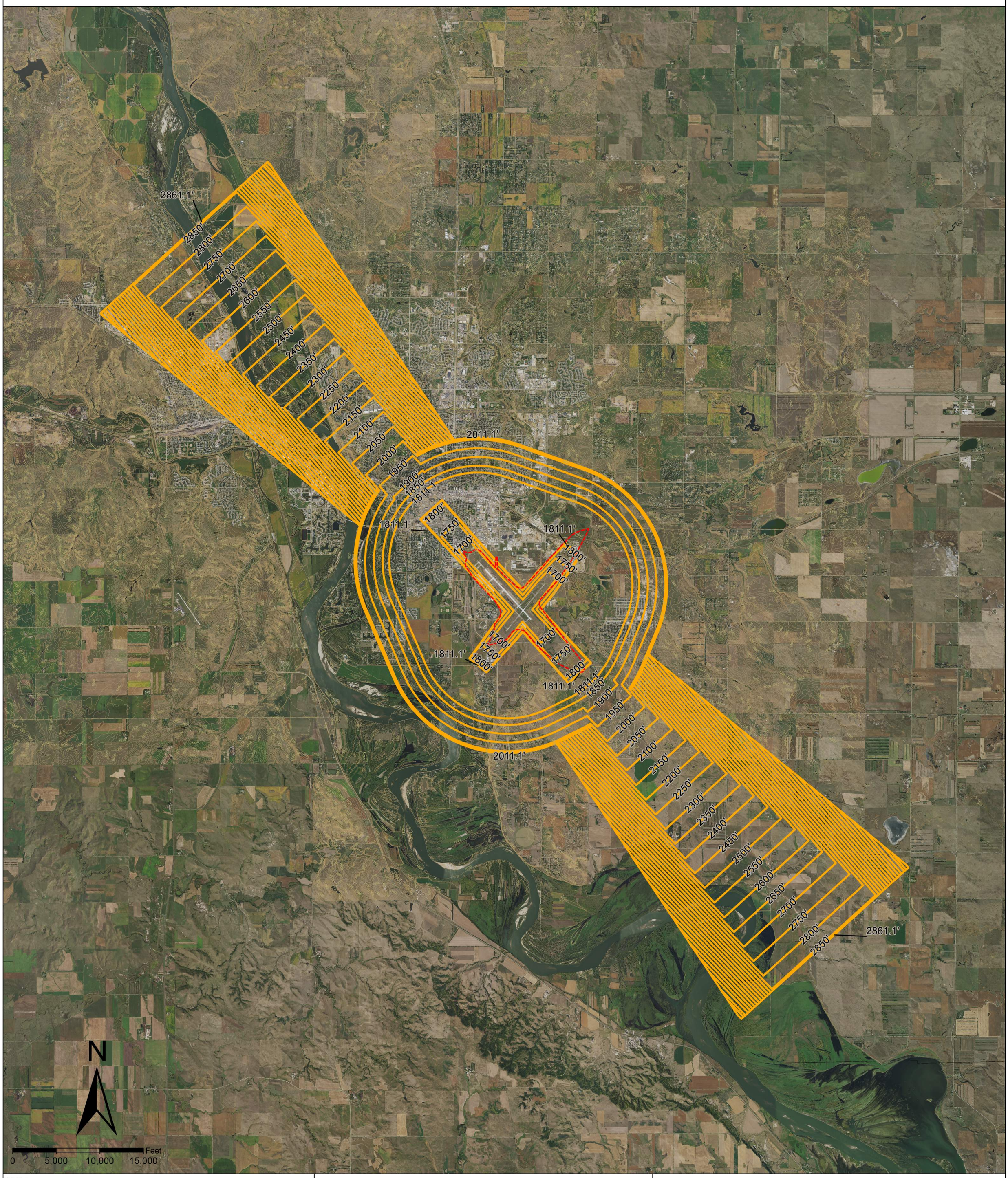
CATEGORY	A	B	C	D
CIRCLING	2240-1 579 (600-1)		2240-1½ 579 (600-1½)	2320-2 659 (700-2)

NC-1, 28 MAR 2019 to 25 APR 2019
NC-1, 28 MAR 2019 to 25 APR 2019



NC-1, 28 MAR 2019 to 25 APR 2019

Bismarck Airport - Airport Zoning Map



Notes:

1. Refer to the City of Bismarck, Code of Ordinances, Title 10-09, Airport Zoning Regulations, for guidance concerning airport zoning.

2. Refer to City of Bismarck, Code of Ordinances, Title 14-04-20, Airport Noise (AN) Overlay Zone, for guidance concerning the 65 day-night average sound level (DNL).

3. Refer to U.S. 14 Code of Federal Regulations (CFR) Part 77 regarding Part 77 contours and surfaces. Part 77 surface elevations are shown in mean sea level (MSL) in feet.

4. Refer the Federal Aviation Regulations (FAR) Part 150, Airport Noise Compatibility Planning Program regarding the 65 DNL.

5. The airport elevation is 1,661.1 feet MSL.

Sources:

1. City of Bismarck, Code of Ordinances, Title 10-09, Airport Zoning Regulations.

2. City of Bismarck, Code of Ordinances, Title 14-04-20, AN Airport Noise Overlay Zone.

3. U.S. 14 Code of Federal Regulations Part 77; Federal Aviation Regulations Part 150, Airport Noise Compatibility Planning Program.

4. Bismarck-Mandan Metropolitan Planning Organization (MPO) Contours (2009).

5. MPO Bismarck Aerial (2016).

6. National Agriculture Imagery Program (NAIP).

Legend

- Bismarck Airport Zoning Ordinance Height Limits
- AN Airport Noise Overlay Zone
- Ground Elevation

10-09-01. This chapter is and may be cited as "Bismarck Airport Zoning Ordinance".

10-09-02. Definitions. As used in this chapter, unless the context otherwise requires:

1. "Airport" means Bismarck Municipal Airport.

2. "Airport elevation" means the established elevation of the highest point of the landing areas and is set at 1,663 feet above sea level.

3. "Airport hazard" means any structure, tree or use of land which obstructs the airspace for or is otherwise hazardous to the flight of aircraft in landing or taking-off at the airport.

4. "Airport reference point" means the point established as the approximate geographic center of the airport landing area and so designated.

5. "Board of adjustment" means a board consisting of five members appointed by the Board of City Commissioners of said city.

Commented [LW1]: It's Bismarck Municipal Airport according to their documentation. I'd suggest making sure this ordinance reflects the proper name throughout.

Commented [BG2R1]: The Airport refers to themselves as Bismarck Airport.

Commented [LW3]: According to AGIS data and survey from 2015, the airport elevation is 1661.1 ft.

Commented [BG4R3]: 1661.1 is correct and is shown on Sheet 2 (Airport Data Sheet) in the BIS ALP set.

Commented [LW5]: Change to mean sea level (MSL). Reflect new airport elevation.

6. "Height". For the purpose of determining the height limits in all zones set forth in this article and

shown on the zoning map, the datum shall mean sea level elevation unless otherwise specified.

7. "Instrument runway" means a runway equipped or to be equipped with electronic or visual air navigation aids adequate to permit the landing of aircraft under restricted visibility conditions.

8. "Landing area" means the area of the airport used for the landing, take-off or taxiing of aircraft.

9. "Nonconforming use" means any structure, tree or use of land which is lawfully in existence at the time the regulation is prescribed in the article or an amendment thereto becomes effective and does not then meet the requirements of said regulation.

10. "Noninstrument runway" means a runway other than an instrument runway.

11. "Person" means an individual, firm, partnership, corporation, company, association, joint stock association, or body politic, and includes a trustee, receiver, assignee, administrator, executor, guardian, or other representative.

Commented [LW6]: Insert space between "non" and "instrument". My main question is if "non instrument runway" is the best definition to use in this document. Does "visual runway" better describe this condition? Part 77 defines a visual runway that is intended solely for the operation of aircraft using visual approach procedures. I would recommend using language similar to what's in Part 77.

Commented [BG7R6]: Agree, recommend use of term visual runway.

12. "Runway" means the paved surface of an airport landing strip.

13. "Structure" means an object constructed or installed by man, including, but without limitation, buildings, towers, smokestacks, and overhead transmission lines.

10-09-03. Creation of Zones. To carry out the provisions of this chapter certain zones are created which include all of the land lying within the instrument approach zones, non-instrument approach zones, transition zones, horizontal zone and conical zone. These areas and zones are shown on the airport zoning map consisting of one sheet, prepared by Mead & Hunt, Inc. and adopted by the Bismarck Community Development Department and dated March 5, 1979, which is made a part hereof, and on file in the offices of the city auditor and the city engineer. The various zones are established and defined as follows:

1. Instrument approach zone. An instrument approach zone is established at each end of the NW-SE instrument runway and at each end of the master planned NE-SW instrument runway, for the purpose of instrument landings and takeoffs. The instrument approach zones have a width of one thousand feet ~~at a distance~~

Commented [LW8]: Runways can also be constructed from turf. Consider changing the language to reflect this. An example would be "paved runway".

Commented [LW9]: If "non-instrument" is replaced with "non-precision", this would be changed to reflect that.

Commented [BG10R9]: Recommend use of term non-precision

Commented [LW11]: This should be "transitional". Additionally, this term isn't defined until further down in the document. I would recommend moving that definition and other pertinent definitions prior to 10-09-03.

Commented [LW12]: Change to "Bismarck Municipal Airport- Airport Zoning Map".

Commented [BG13R12]: Omit the word "municipal" -see previous comment

Commented [LW14]: Suggest using "located".

Commented [LW15]: Awkward wording. Suggest re-wording to "end of the NE-SW instrument runway as reflected in the..."

Commented [LW16]: "and begin two hundred feet beyond the ends of the runways..."

of two hundred feet beyond the ends of the runways, widening thereafter uniformly to a width of sixteen thousand

feet ~~at a distance of~~ fifty thousand two hundred feet beyond the ends of the runways, the center lines being the continuation of the center lines of the runways.

2. Non-instrument approach zones. A non-instrument approach zone is established at each end of all existing and master planned non-instrument runways for the purpose of non-instrument landings and takeoffs. The non-instrument approach zone of the NE-SW runway and the master planned NW-SE runway have a width of two hundred fifty feet at a distance of two hundred feet beyond each end of the runways, widening thereafter uniformly to a width of one thousand two hundred fifty feet at a distance of five thousand two hundred feet beyond each end of the runways, the center lines being the continuation of the center lines of the runways. The non-instrument approach zone of the N-S runway has a width of five hundred feet at a distance of two hundred feet beyond each end of the runway, widening thereafter uniformly to a width of two thousand five hundred feet at a distance of ten thousand two hundred feet beyond each end of the runway, its center line being the continuation of the center line of the runway.

3. Transition zones. Transition zones are established adjacent to each existing and master planned instrument and non-

Commented [LW17]: "and extends…"

Commented [LW18]: Unless there's a logical reason to leave these numbers spelled out, I would recommend using the numerical value instead of words. These are large numbers and it's easier to process while reading if they are in number form.

Commented [LW19]: I get what this means, but I am not sure this is the best way to present this. Perhaps some language can be added than discusses how the centerlines of the instrument approach zones are the extended centerlines of the runways.

Commented [LW20]: See previous comments about whether or not this is a good term to carry throughout the ordinance.

Commented [BG21R20]: Recommend use of non-precision approach zones

Commented [LW22]: Future or ultimate may be some language appropriate for this and would match the language in the recent master plan. If this were to change, it should be reflected throughout the ordinances.

Commented [BG23R22]: Recommend use of term future

Commented [LW24]: While this is correct, I suggest that the ordinance also include definitions of the primary surface. The inner width of the primary surface is also the inner width of the approach surface (or, non-instrument approach zones).

Commented [LW25R24]: 14 CFR Part 77.19, Civil Airport Imaginary Surfaces, Section C:
"**(c)*Primary surface.*** A surface longitudinally centered on a runway. When the runway has a specially prepared hard surface, the primary surface extends 200 feet beyond each end of that runway; but when the runway has no specially prepared hard surface, the primary surface ends at each end of that runway. Th … [1]

Commented [LW26]: See previous comment. It's important to distinguish this surface *begins* 200 feet b … [2]

Commented [LW27]: "runway end".

Commented [LW28]: Perhaps it would be a good idea to make sure there is a reference to the ALP or the Maste … [3]

Commented [LW29]: This dimension is correct. However, Part 77 uses this dimension for other than utility runw … [4]

Commented [LW30]: "begins 200 feet beyond each runway end" or something along that line.

Commented [LW31]: "and widens uniformly to…"

Commented [LW32]: See previous comment about extended centerline.

Commented [LW33]: Consider using "Transitional zones". Part 77 uses transitional surfaces.

instrument runway and approach zone as indicated on the zoning map. Transition zones symmetrically located on either side of the runways have variable widths as shown on the zoning map. Transition zones extend outward from a line one hundred twenty-five feet on either side of the center lines of the NE-SW and the master planned NW-SE non-instrument runways, and two hundred fifty feet on either side of the center line of the N-S non-instrument runway, for the length of the runways plus two hundred feet on each end, and are parallel and level with the runway center lines. Transition zones extend outward from a line five hundred feet on either side of the center line of the NW-SE and the master planned NE-SW instrument runways, for the length of the runways plus two hundred feet on each end, and are parallel and level with the runway center lines. The transition zones along the runways slope upward and outward one foot vertically for each seven feet horizontally to the point where they intersect the surface of the horizontal zone. Further, transition zones are established adjacent to the instrument and non-instrument approach zones for the entire length of the approach zones. These transition zones have variable widths, as shown on the zoning map.

Commented [LW34]: Not sure where they are getting this number unless this was established above and beyond what Part 77 requires.

Part 77 states:
"**(e)*Transitional surface.*** These surfaces extend outward and upward at right angles to the runway centerline and the runway centerline extended at a slope of 7 to 1 from the sides of the primary surface and from the sides of the approach surfaces. Transitional surfaces for those portions of the precision approach surface which project through and beyond the limits of the conical surface, extend a distance of 5,000 feet measured horizontally from the edge of the approach surface and at right angles to the runway centerline."

Commented [LW35]: "and extends 200 feet beyond each runway end" is an example of how this could be cleaned up and more readable.

Commented [LW36]: Is this really necessary to the sentence? Could use "which are parallel and level to the runway center lines."

Commented [LW37]: What line? Is this supposed to say "center line"? Also, centerline should be one word and not two.

The transition zones flare symmetrically with either side of the runway approach zones from the base of the zones and slope upward and outward at the rate of one foot vertically for each seven feet horizontally to the points where they intersect the surfaces of the horizontal and conical zones. Additionally transition zones are established adjacent to the instrument approach zones where they project through and beyond the limits of the conical zone, extending a distance of five thousand feet measured horizontally from the edge of the instrument approach zones at right angles to the continuation of the center line of the runways.

4. Horizontal zone. A horizontal zone is established as the area contained within the following described boundary, the perimeter of which is constructed by swinging arcs of ten thousand two hundred feet from each end of the NW-SE runway and the master planned NE-SW runway, and connecting the adjacent arcs of lines tangent to those arcs. The horizontal zone does not include the instrument and non-instrument approach zones and the transition zones.

5. Conical zone. A conical zone is established as the area that commences at the periphery of the horizontal zone and extends outward therefrom a distance of four thousand feet. The conical

Commented [LW38]: Some of this is redundant language. However, the piece about the intersection of the horizontal and conical zones should be worked into the previous sentence(s).

Commented [LW39]: Comma (",") here.

Commented [LW40]: A blanket comment is to rearrange these sections to reflect the order in Part 77. Each surface (or "zone") builds off of the other and might help a reader connect the dots, so to speak.

Commented [LW41]: The arcs are swung from the center of each end of the primary surface… Which is the technically lies at the end of each runway end.

Commented [LW42]: Not sure this a real word. Suggest using "extends outward for a distance of four thousand feet."

zone does not include the instrument approach zones and transition zones.

10-09-04. Zone Height Limits.

1. Except as otherwise provided in this chapter, a structure or tree may not be erected, altered, allowed to grow, or maintained in any zone to a height in excess of the height limit established for the zone. The height limitations established for each of the zones are as follows:

a. Instrument approach zones. One foot in height for each fifty feet in horizontal distance beginning at a point two hundred feet from and at the elevation of the end of the runway extending to a distance of ten thousand two hundred feet from the end of the runway; thence one foot in height for each forty feet in horizontal distance to a point fifty thousand two hundred feet from the end of the runway.

b. Non-instrument approach zones. One foot in height for each forty feet in horizontal distance beginning at a point two hundred feet from and at the elevation of the end of the runway, extending to a point ten thousand two hundred feet from the end of the runway, said zones are established at the ends of the N-S non-instrument runway. One foot in height for each twenty feet in horizontal distance beginning at a point two hundred feet from and at the elevation of the end of the runway, extending to a point five thousand two hundred feet from the end of the runway.

c. Transition zones. One foot in height for each seven feet in horizontal distance beginning at any point one hundred twenty-five feet normal to and at the respective elevations of the center lines of the NE-SW non-instrument runway and the master planned NW-SE non-instrument runway and two hundred fifty feet normal to and at the elevation of the center line of the N-S non-instrument runway extending two hundred feet beyond each end, and five hundred feet normal to and at the respective elevations of the center lines of the NW-SE instrument runway, extending two hundred feet beyond each end extending to a height of one hundred fifty feet above the airport elevation which is one thousand six hundred sixty-three feet above mean sea level. In addition, there are established height limits of one foot

Commented [LW43]: "ten thousand two hundred feet beyond the runway end."

Commented [LW44]: Check this?

Commented [LW45]: See previous comments about airport elevation.

Commented [BG46R45]: 1661.1' MSL

vertical height for each seven feet horizontal distance measured from the edges of all approach zones for the entire length of the approach zones and extending upward and outward to the points where they intersect the horizontal or conical surfaces. Further, where the instrument approach zones project through and beyond the conical zone, a height limit of one foot for each seven feet of horizontal distance must be maintained beginning at the edge of the instrument approach zones and extending a distance of five thousand feet from the edge of the instrument approach zones measured normal to the center lines of the runways extended.

d. Horizontal zone. One hundred fifty feet above the airport elevation or a height of one thousand eight hundred thirteen feet above mean sea level.

e. Conical zone. One foot in height for each twenty feet horizontal distance beginning at the periphery of the horizontal zone; extending to a height of three hundred fifty feet above the airport elevation.

Commented [LW47]: "Furthermore"?

Commented [LW48]: Is this word necessary for this ordinance? What purpose does it serve?

Commented [LW49]: This isn't correct. Survey from 2015 shows that airport elevation is 1661.1 ft. So 150' above airport elevation is 1,811.1 feet.

2. Where an area is covered by more than one height limitation the more restrictive limitation prevails.

10-09-05. Use Restrictions. Notwithstanding any other provisions of this chapter, a use may not be made of the land within a zone established by this chapter in a manner which creates electrical interference with radio communication between the airport and aircraft, makes it difficult for flyers to distinguish between airport lights and others, results in glare in the eyes of flyers using the airport, impairs visibility in the vicinity of the airport or otherwise endangers the landing, takeoff or maneuvering of aircraft.

10-09-06. Regulations Not Retroactive.

1. The provisions of this chapter are not retroactive as to any structure or tree not in conformity with these regulations on January 24, 1967, nor shall the regulations affect the continuance of the non-conformity. In addition, this chapter does not require any change in the construction or alteration of the intended use of a structure which was began prior to January 24, 1967, and diligently prosecuted.

Commented [LW50]: Insert comma (,) here.

Commented [LW51]: Does it make sense to add anything in regards to wind turbines, or are we assuming this zoning ordinance will preclude them altogether?

Commented [LW52]: Date will need to change to reflect updated ordinance.

Commented [LW53]: See previous comment.

2. Notwithstanding subsection 1, the owner of any nonconforming structure or tree shall permit the installation, operation and maintenance of the markers and lights the airport manager deems necessary to indicate to the operators of aircraft in the vicinity of the airport, the presence of such airport hazards. The markers and lights are to be installed, operated and maintained at the expense of the city.

10-09-07. Use Permits.

1. Future uses: Except as specifically provided in paragraphs a, b and c, a material change may not be made in the use of land and a structure or tree may not be erected, altered, planted or otherwise established in any zone hereby created unless a permit therefor has been applied for and granted. Each application for a permit shall indicate the purpose for which the permit is desired, with sufficient particularity to permit it to be determined whether the resulting use, structure or tree would conform to the regulations herein prescribed. If such determination is in the affirmative, the permit must be granted.

Commented [LW54]: Should this be director? The airport calls this position airport director.

Commented [BG55R54]: Recommend airport director

a. In the area lying within the limits of the horizontal zone and the conical zone, a permit is not required for any tree or structure less than seventy-five feet of vertical height above the ground, except when because of terrain, land contour or topographic features such tree or structure would extend above the height limits prescribed for such zone.

b. In the areas lying within the limits of the instrument and non-instrument approach zones but at a horizontal distance of not less than 42,000 feet from each end of the runways, a permit is not required for any tree or structure less than seventy-five feet of vertical height above the ground, except when such tree or structure would extend above the height limit prescribed for such instrument or no-instrument approach zone.

c. In the areas lying within the limits of the transition zones beyond perimeter of the horizontal zone, a permit is not required for any tree or structure less than seventy-five feet of vertical height above the ground except when such tree or structure, because of terrain, land contour or topographic features would extend beyond the height limit prescribed for such transition zones.

Nothing in the foregoing exceptions may be construed as permitting or intending to permit any construction, alteration or growth of any structure or tree in excess of the height limits, except as set forth in section 10-09-04.

2. Existing uses: Permits may not be granted that would allow the establishment or creation of an airport hazard or permit a nonconforming use, structure or tree to be made or become higher, or become a greater hazard to air navigation, than it was on January 24, 1967, or than it was when the application for a permit is made. Except as indicated, all applications for such a permit shall be granted.

3. Non-conforming uses abandoned or destroyed: Whenever the airport manager determines that a non-conforming structure or tree has been abandoned or is more than eighty percent torn down, physically deteriorated, or decayed, a permit may not be granted to allow the structure or tree to exceed the applicable height limit or otherwise deviate from the zoning regulations.

4. Variances: Any person desiring to erect or increase the height of any structure, or permit the growth of any tree, or use his or her property, not in

Commented [LW56]: This is an odd word; perhaps "aforementioned" might be a better choice.

Commented [LW57]: See previous comments.

Commented [LW58]: See previous comment.

accordance with the regulations, ma apply to the board of adjustment for a variance from the regulations. The variances may be allowed if it is found that a literal application or enforcement of the regulations would result in practical difficulty or unnecessary hardship and the relief granted is not contrary to the public interest but would do substantial justice and be in accordance with the spirit of this chapter.

5. Hazard lighting and marking: Any permit or variance granted may, if deemed advisable and reasonable in the circumstances, be conditioned on the owner of the structure or tree in question permitting the city at its own expense, to install, operate and maintain thereon such markers and lights as may be necessary to indicate to flyers the presence of an airport hazard.

10-09-08. Enforcement. It is the duty of the airport manager to administer and enforce the regulations of this chapter. Applications for permits and variances must be made to the airport manager on a form furnished by him or her. Applications required by this chapter to be submitted to the airport manager shall be promptly considered and granted or denied. Applications for action by the board of adjustment shall be forthwith transmitted by the airport manager.

Commented [LW59]: Word is misspelled. “may”

Commented [LW60]: See previous comments.

Commented [LW61]: See previous comments.

Commented [LW62]: See previous comments.

10-09-09. Board of Adjustment. The existing city board of adjustment shall exercise the powers granted in section 2-04-10 of the North Dakota Century Code.

10-09-10. Administrative Appeal.

1. Any person aggrieved, or any taxpayer affected, by a decision of the airport manager may appeal to the board of adjustment.

Commented [LW63]: See previous comments.

2. All appeals must be taken within a reasonable time as provided by the rules of the board of adjustment, by filing with the airport manager a notice of appeal specifying the grounds. The airport manager shall transmit to the board of adjustment all the papers constituting the record upon which the action appealed from was taken.

Commented [LW64]: See previous comments.

Commented [LW65]: See previous comments.

3. An appeal stays all proceedings in furtherance of the action appealed from, unless the airport manager certifies to the board of adjustment, after the notice of appeal is filed with it, that by reason of the facts stated in the certificate a stay would, in his opinion, cause imminent peril to life or property. In that case, proceedings shall not be stayed except by order of the board of adjustment on notice to the

Commented [LW66]: See previous comments.

agency from which the appeal is taken and on due cause shown.

4. The board of adjustment shall fix a reasonable time for hearing appeals, give public notice and due notice to the parties in interest, and decide the appeal within a reasonable time. At the hearing any party may appear in person or by agent or by attorney.

5. The board of adjustment may reverse or affirm, in whole or in part, or modify the order, requirement, decision or determination appealed from and may make such order, requirement, decision or determination as may be appropriate under the circumstances.

10-09-11. Judicial Review. Any person aggrieved, or taxpayer affected, by a decision of the board of adjustment, may appeal to the board of city commissioners and may appeal an adverse decision of the board of city commissioners to the district court as provided in the North Dakota Century Code.

10-09-12. Conflicting Regulations. Where there exists a conflict between any of the regulations or limitations prescribed in this chapter and any other regulations applicable to the same area,

the more stringent limitation or requirement shall govern and prevail.

Page 6: [1] Commented [LW25R24] **Lydia Werner** **5/7/2019 10:23:00 AM**

14 CFR Part 77.19, Civil Airport Imaginary Surfaces, Section C:

"**(c)*Primary surface.*** A surface longitudinally centered on a runway. When the runway has a specially prepared hard surface, the primary surface extends 200 feet beyond each end of that runway; but when the runway has no specially prepared hard surface, the primary surface ends at each end of that runway. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline. The width of the primary surface is:

(1) 250 feet for utility runways having only visual approaches.

(2) 500 feet for utility runways having non-precision instrument approaches.

(3) For other than utility runways, the width is:

(i) 500 feet for visual runways having only visual approaches.

(ii) 500 feet for non-precision instrument runways having visibility minimums greater than three-fourths statute mile.

(iii) 1,000 feet for a non-precision instrument runway having a non-precision instrument approach with visibility minimums as low as three-fourths of a statute mile, and for precision instrument runways.

(iv) The width of the primary surface of a runway will be that width prescribed in this section for the most precise approach existing or planned for either end of that runway."

Page 6: [2] Commented [LW26] **Lydia Werner** **4/23/2019 9:56:00 AM**

See previous comment. It's important to distinguish this surface *begins* 200 feet beyond the runway ends. This could be read as it ends 200 feet beyond the runway end.

Page 6: [3] Commented [LW28] **Lydia Werner** **4/23/2019 10:00:00 AM**

Perhaps it would be a good idea to make sure there is a reference to the ALP or the Master plan when referring to the different runways?

Page 6: [4] Commented [LW29] **Lydia Werner** **4/23/2019 10:03:00 AM**

This dimension is correct. However, Part 77 uses this dimension for other than utility runways which are non-precision instrument runways. Adding language that coincides with Part 77 language and perhaps directing readers to Part 77 in addition to zoning ordinances might be wise. If Bismarck has more restrictive ordinances than what is covered in part 77, it certainly shouldn't be the end all be all.

14-04-20. AN Airport Noise Overlay District. In any AN Airport Noise overlay district, the following regulations shall apply: 1. General description. The AN Airport Noise overlay district for the area around the Bismarck Municipal Airport is hereby established based on the analysis and recommendations of the F.A.R. Part 150 Noise Compatibility Plan prepared for the Bismarck Municipal Airport. The AN zone is an overlay zone, the requirements and standards of which shall supplement the requirements and standards of the underlying zone. For the AN Airport Noise district, in promoting the general purposes of this ordinance, the specific interest of this section is:

a. To establish specific standards within noise-impacted areas to help mitigate the problems caused by airport noise.

b. To encourage the establishment of, and continuing operation of land uses within the overlay district which are compatible with the recommendations of the F.A.R. Part 150 Noise Compatibility Plan for the airport.

c. To permit the establishment of, and continuing operation of land uses within the overlay district which are non-compatible with the recommendations of the F.A.R. Part 150 Noise Compatibility Plan for the airport, provided such uses are located on lots of record which exist as of the date of enactment of this ordinance.

d. To prohibit the development of new noise-sensitive land uses within the overlay district, except as provided under the provisions of this ordinance.

Commented [LW1]: If AN stands for Airport Noise, that needs to be indicated. For instance "Airport Noise (AN)…"

Commented [LW2]: "Federal Aviation Regulations (FAR)"

Commented [LW3]: Airport Noise Compatibility Planning is the correct term.

Commented [LW4]: See previous comment.

Commented [LW5]: See previous comments.

2. AN district boundaries. The boundaries of the AN airport noise district are shown on the official zoning map of the city and generally correspond to the area impacted by noise exceeding 65 Ldn based on a combination of noise contours for the 1989 Official Noise Exposure Map, the 1990 Noise Compatibility Plan, and the 1995 Noise Compatibility Plan as presented in the F.A.R. Part 150 Noise Compatibility Study prepared for the Bismarck Municipal Airport and dated February 12, 1991.

3. Definitions.

a. Day-Night Sound Level(Ldn): A cumulative noise metric which describes the noise occurring during a 24-hour period as averaged over one year. The Ldn metric assesses a 10 dB penalty to all noise events occurring between 10:00 p.m. and 7:00 a.m., reflecting the greater annoyance associated with nighttime noise.

b. Ldn Contour: A line linking together a series of points of equal cumulative noise exposure based on the Ldn metric. Aircraft noise contours are developed based on aircraft flight patterns, number of daily aircraft operations by type of aircraft and time of day, noise characteristics of each aircraft, and typical runway usage patterns.

c. Lot of Record: A record lot as defined in Section 14-02-03 of the Zoning Ordinance.

d. Navigable Airspace: The airspace above the minimum altitudes of flight prescribed by regulations issued under the Federal Aviation Act of 1958, Section 101(24) 49 United States Code 1301, including the

Commented [LW6]: Should be included in the city zoning map. Add an additional location for "Bismarck Airport - Airport Zoning Map". In other words, reference the map we are providing the City of Bismarck.

Commented [LW7]: Day-night average sound level (DNL).

Commented [LW8]: See previous comments.

Commented [LW9]: See previous comments.

Commented [LW10]: See previous comments.

Commented [LW11]: See previous comments.

Commented [LW12]: See previous comments.

airspace needed to ensure safety in the take-off and landing of aircraft.

e. Noise Compatibility Plan: A plan developed in conformance with Part 150 of the Federal Aviation Regulations proposing noise abatement and land use management measures to reduce the adverse impact of aircraft noise on surrounding residents and noise-sensitive land uses.

f. Non-compatible Land Use: A land use shown in the Table of Land Use Compatibility Standards as not permitted within the AN Airport Noise Overlay Zone.

g. Official Noise Exposure Map: A map showing either existing or forecast aircraft noise exposure prepared in conformance with Part 150 of the Federal Aviation Regulations.

4. Uses permitted. Land uses permitted in the AN district shall be as specified in the Table of Land Use Compatibility Standards.

5. Use prohibited. Land uses prohibited in the AN district shall be as specified in the Table of Land Use Compatibility Standards.

6. Land Use Compatibility Standards:

TABLE OF LAND USE COMPATIBILITY STANDARDS

SLUCM NO.	***Land Use Name***	***Overlay Zoning District AN (65+Ldn)***
10	***Residential***	
11	Household units	
11.11	Single Unit - detached	
11.12	Single Unit - semi-detached	N[1]

Commented [LW13]: FAR Part 150 instead.

Commented [LW14]: If "AN" is an abbreviation of Airport Noise, consider using one or the other and not both.

Commented [LW15]: See previous comment.

Commented [LW16]: See two comments prior.

Commented [LW17]: See previous comment.

Commented [LW18]: Use "DNL".

11.13	Single Unit - attached row	N[1]
11.21	Two units - side by side	N[1]
11.22	Two units - over-under	N[1]
11.31	Apartments - walk-up	N[1]
11.32	Apartments - elevator	N[1]
12	Group quarters	N[1]
13	Residential hotels	N[1]
14.1	Mobile home parks	N[1]
14.2	Mobile homes in existing parks	N
15	Transient lodgings, hotels, motels	N[1]
16	Other residential	N[1]
20 ***MANUFACTURING***		
21	Food & kindred products	
22	Textile mill products	Y
23	Apparel & other finished products made from fabrics, leather & similar materials	Y
24	Lumber & wood products (except furniture)	Y
25	Furniture & fixtures	Y

26	Paper & allied products	Y
27	Printing, publishing & allied industries	Y
28	Chemicals & allied products	Y
29	Petroleum refining and related industries	Y
30	***MANUFACTURING (Continued)***	Y
31	Rubber & miscellaneous plastic products	
32	Stone, clay & glass products	Y
33	Primary metal industries	Y
34	Fabricated metal products	Y
35	Professional, scientific & controlling instruments; photographic & optical goods; watches & clocks	Y
39	Miscellaneous manufacturing	Y

MASTER PLAN UPDATE

Bismarck AIRPORT

APPENDIX D

APPENDIX D

Bismarck Airport Waste and Recycling Plan

EXECUTIVE SUMMARY

The City of Bismarck, North Dakota, operator of Bismarck Municipal Airport (BIS or the Airport) is committed to environmentally responsible operations. The Airport is updating its master plan and has included a solid waste plan in accordance with the *FAA Modernization and Reform Act of 2012* (FMRA) requirements. The purpose of this task is to evaluate BIS's existing waste and recycling program and to provide recommendations for increasing landfill diversion through waste reduction, reuse, and recycling.

The consultant conducted a facility walk-through and informal interviews with BIS staff to develop a baseline and to identify areas of opportunity to divert waste from the landfill. The consultant developed recommendations appropriate for the Airport's waste stream based on the baseline information.

Highlights of these recommendations include:

- Establish goals and objectives
- Track progress and report regularly
- Promote emptying of water bottles pre-security and refilling post-security
- Collect and donate food, beverages, and toiletries
- Encourage reuse of items and materials
- Continue paper, plastic, plastic bottle, aluminum can, cardboard, and glass recycling and expand to other areas, including deplaned waste
- Improve education and outreach for passengers, employees, tenants, and contractors
- Supplement, right size, collocate, and standardize recycling stations and garbage cans
- Expand and improve signage, specifically at the security checkpoint
- Update contracts/leases and establish purchasing policy
- Maintain and improve recycling program according to Plan Do Check Act cycle.

This range of recommendations will allow BIS the flexibility to implement those that are compatible with changing conditions and available resources, while providing the opportunity to increase landfill diversion over time through a phased, comprehensive program.

1. Introduction

A. Regulatory Background and Project Purpose

Section 132(b) of the FMRA expanded the definition of airport planning to include "developing a plan for recycling and minimizing the generation of airport solid waste." FMRA Section 133 added a requirement that airports that prepare or update a master plan and receive Federal Aviation Administration (FAA) Airport Improvement Program (AIP) funding ensure that new or updated master plans address issues related to solid waste recycling. These issues include:

1) the feasibility of solid waste recycling
2) minimizing the generation of solid waste
3) operation and maintenance requirements
4) review of waste management contracts
5) the potential for cost savings or revenue generation.

In September 2014, the FAA released a memorandum titled "Guidance on Airport Recycling, Reuse, and Waste Reduction Plans." This memo details the FAA's expectations and suggestions for an airport's recycling plan. To comply with FMRA and the FAA's guidance memo, BIS is preparing this recycling, reuse, and waste reduction plan. The purpose of this plan is to document and assess BIS's existing waste and recycling program based on the factors listed above and to recommend improvements.

An airport's waste and recycling program and documented plan depend on several factors including:

- the size, location, and layout of the airport
- the amount and type of waste generated
- markets for recyclable commodities
- costs for recycling
- available local infrastructure
- the willingness of an airport and its tenants to implement recycling and other strategies.

The extent and accuracy of available information governed the content of this plan.

B. Airport Description

BIS is in the southern half of central North Dakota, approximately 200 miles west of Fargo, North Dakota and 175 miles east of the Montana-North Dakota border. It is in Burleigh County. The City of Bismarck owns BIS and is the official sponsor of the Airport. The City of Bismarck itself is organized into a five-member city commission which is elected at large. The commission is led by the Mayor of Bismarck. The Airport Director reports directly to the City Commission and is responsible for day to day airport operations. The director is supported by an Assistant Airport Director who has direct responsibility for three lines of business: operations, administration, and maintenance.

BIS is a primary, non-hub, commercial service airport, serving the capital city of North Dakota and the state as a whole. The Airport is a public-use facility and is included in the FAA National Plan of Integrated Airport Systems (NPIAS). The Airport is an FAA Class I Part 139 facility, with facilities and services to accommodate scheduled passenger aircraft with 30 or more passenger seats. In 2014, the North Dakota Aeronautics Commission (NDAC) abandoned their previous proprietary airport classification system in favor of using the criteria published by the FAA.

The Airport serves commercial, general aviation (GA), air cargo, Army National Guard, military, air ambulance service, flight training, and aircraft maintenance activities. In fiscal year 2018, BIS had approximately 563,850 total passengers, 54,510 total operations, and 117 based aircraft. Five airlines serve the Airport (Allegiant, American Airlines, Delta Airlines, Frontier Airlines, and United Airlines) with direct connections to seven domestic destinations. Additional background and activity information is available in the Airport Master Plan Update.

C. Waste Definitions and Plan Focus

Municipal Solid Waste (MSW) consists of everyday items that are used and then discarded. There are six primary types of MSW generated at airports:

a. General MSW consists of common inorganic waste, such as product packaging, disposable utensils, plates and cups, bottles, and newspaper. Less common items, such as furniture and clothing, are also considered general MSW.
b. Food waste is either food that is not consumed or the waste generated and discarded during food preparation. Food waste and green waste make up a waste stream known as “compostable” waste.
c. Green waste consists of tree, shrub and grass clippings, leaves, weeds, small branches, seeds, pods and similar debris generated by landscape maintenance activities. Green waste and food waste together may be referred to as “compostables.”

d. Deplaned waste is a specific type of MSW that is removed from passenger aircraft. These materials include bottles and cans, newspaper and mixed paper, plastic cups, service ware, food waste, food soiled paper, and paper towels.
e. Construction and Demolition Waste (C&D) is generally categorized as MSW and is any non-hazardous solid waste from land clearing, excavation, and/or the construction, demolition, renovation or repair of structures, roads, and utilities. C&D waste commonly includes concrete, wood, metals, drywall, carpet, plastic, pipes, land clearing debris, cardboard, and salvaged building components.

This plan focuses on the management of MSW and other materials that can be recycled or disposed of in a landfill. This plan does not address the management of other types of waste, specifically:

- hazardous waste
- universal waste
- industrial waste
- waste from international flights
- C&D waste that is subject to special requirements or requires special handling (asbestos, lead, etc.).

The handling, recycling, and disposal of these materials are regulated by federal, state, and local laws.

D. Key Airport Buildings and Plan Scope

The Airport's buildings include an airline passenger terminal with airport administration offices, Aircraft Rescue and Fire Fighting (ARFF) station, airport operations building, airport maintenance building, and other support facilities and maintenance areas.

Airline Passenger Terminal

In May 2005, Bismarck completed construction of a state-of-the-art terminal that serves airline passengers and provides space for airline-related services. The terminal building consists of two levels. The non-secure area is located immediately to the west and includes the two primary entrance ways; public greeting space; rental car counters; baggage claim; ticketing; lobby seating; a small food and beverage concessionaire; vending; public restrooms; and the North Dakota Hall of Fame Museum. The secure area is located to the east and makes up the second half of level one. This area includes the baggage screening area, airline office space, and airline storage.

Consistent with level one, level two consists of a non-secure and secure area and is accessed by an elevator, escalator, and a two-sided stair case located in the midpoint of the terminal building. The non-secure area includes the airport administration offices; Transportation Security Administration (TSA) office; airport security office; TSA checkpoint; conference room; public restrooms; and airport storage room. Each of these facilities is connected by a linear hallway spanning the entire length of the terminal building. The administrative office area includes private offices, open reception area, administrative conference room, break room, and private restrooms. The TSA screening area has two lanes for passengers. TSA personnel also have access to training areas, locker room space, and offices. The Bismarck Police airport section and the contract security firm providing airport security services has an office located on the second floor of the terminal. . A second conference room is located north of the TSA checkpoint and is frequently used by TSA and other public meetings.

The level two secure area is accessed through the TSA checkpoint and includes a large non-partitioned holdroom which spans the entire length of the building. The holdroom is made up of public seating including traditional passenger seating clusters, business cubicles, as well as a passenger circulation area spanning the entire length of the second level. The level two secure area also includes a café/gift shop; public restrooms; vending machines; and a game room.

A café/gift shop is located on the second floor of the secure area and features a booth and counter seating, as well as high top seating. This concessionaire sells packaged food and beverages, as well as souvenirs and retail items.

On the secure side of the second floor, there are four gates serving deplaning and enplaning passengers with each gate dedicated to one airline. Holdrooms, where passengers wait to board departing flights within the departure lobby, are loosely defined at BIS by their proximity to each gate.

Additional areas of the terminal are accessible only to credentialed staff and contractors.

Airport Support Facilities

BIS staff maintain the Airport property and perform snow removal and deicing activities. The Airport's plows, other winter equipment, and grounds maintenance vehicles are stored in the Snow Removal Equipment (SRE) Building. A separate maintenance/storage building is used for SRE equipment maintenance and has staff restrooms, office space, and a crew rest area.

ARFF is the responsibility of the City of Bismarck and is staffed by the Rural Metro Fire Department, who serve as contract employees. On-duty firefighters, ARFF vehicles, and associated activities are housed in a dedicated ARFF facility at BIS which includes a restroom with shower facilities, a training room, a fitness area, a break area, and office space.

General Aviation Facilities and Business Tenants

Many of the hangars at BIS are either owned by one of two Fixed Based Operators (FBOs), Bismarck Aero Center and Executive Air, for their use or are leased to tenants for their flight operations. The FBOs provide services such as general aircraft maintenance, avionics, charter brokerage, aircraft rental, flight instruction, fueling, aircraft sales, ground school, hangar storage and pilot services to support GA activity at BIS. Other tenants at BIS include North Dakota Aeronautics Commission; North Dakota Fish and Game; North Dakota State Patrol; FedEx; Basin Electric Corporation; Montana-Dakota Utilities (MDU); the North Dakota Army National Guard; FAA and Motix. The Bismarck Aero Center complex houses the North Dakota Aeronautics Commission staff offices.

In the GA area at BIS, there are box hangars and T-hangars to store GA aircraft. Both Basin Electric and MDU utilize a large corporate hangar adjacent to Taxiway E. The North Dakota Army National Guard facility is located on the south end of the airfield.

Air Cargo

Air cargo facilities at BIS are made up of hangars and adjacent areas of the aircraft ramp/apron. FedEx, UPS and United States Postal Service (USPS) operate at BIS.

Plan Scope

The facilities described above include buildings and areas in which BIS has direct control of waste management and others in which BIS has influence but not direct control. According to FAA guidance, areas over which BIS has “direct control” or ”influence” should be included in the Recycling, Reuse, and Waste Reduction Plan; areas outside Airport control or influence may be excluded. The Airport has direct control over operations and activities related to waste management in these areas:

- Passenger Terminal Building
  - public use spaces
  - airport administration offices
  - other staff work areas
- Airport SRE Building
- ARFF building (coordination with City of Bismarck)
- Airport maintenance activities

In addition, BIS may influence the management of waste and recycling in tenant spaces through individual leases and contracts, including:

- Passenger Terminal Building Tenants
  - TSA spaces
  - Airline leased areas (including ticketing counters, offices, breakrooms, baggage makeup, and deplaned waste)
  - Rental car tenant areas
  - Terminal tenant areas (concessionaire and retail areas)
- FBO Buildings
- Aircraft hangars/GA facilities
- Other tenants on BIS property
- Contractor activities

Bismarck Airport provides custodial services and waste removal in all TSA areas under contract. The Airport may not have control over the FAA Airport District Office (ADO) and Airport Traffic Control Tower (ATCT); therefore, these facilities and areas are excluded from this plan.

2. Existing Program

A. Drivers

The Airport established its recycling program to reduce the quantity of material disposed of in the landfill and to conserve resources, including financial resources. The Airport staff commitment and practices drive the program. While recycling programs are not mandated by the City of Bismarck, the Airport's recycling program is supported by local recycling infrastructure.

B. Alignment with Local Programs

The City of Bismarck contracts with Waste Management, a waste hauling contractor, to provide waste and recycling collection services for residents, multifamily units, and commercial businesses. BIS's program aligns with the City's efforts; BIS recycles all the material types collected by the City's contractor.

C. Infrastructure

Employees, tenants, and passengers have access to a network of trash cans and recycling stations in the terminal. In general, there are many trash cans throughout the building and a few recycling stations in specific locations. The garbage cans are lined/fitted with bags, while the recycling bins are generally unlined/do not have bags.

In the ticketing lobby and airline counter area, there are tall round, metal garbage cans with round openings in the lids (Figure 1). These large garbage cans are also available at the entrance to the security screening checkpoint (Figure 2), in the public greeting space and baggage claim area (Figure 3 and Figure 4), and throughout the sterile area, including in the holdrooms (Figure 5), near the concessionaire on the second floor (Figure 6), and near the gates (Figure 7). There are also several smaller, plastic garbage cans located throughout the non-sterile area (Figure 8). Next to the garbage can at the security screening checkpoint, there is also an amnesty box, which is for safe and secure disposal of items prohibited at the checkpoint (Figure 2).

Figure 1 – Pre-security garbage can and recycling bin for cans and bottles in ticketing lobby/baggage claim

Figure 2 - Garbage can and amnesty box at security screening checkpoint

Figure 3 - Garbage cans near first floor concessionaire and public greeting area

Figure 4 - Garbage cans in public meeting and baggage claim area

Figure 5 - Garbage cans in holdroom

Figure 6 - Garbage can in secure area near second floor concessionaire

Figure 7 - Garbage can near gate 2

Figure 8 - Small garbage can in non-sterile area of the terminal

Recycling stations at BIS are separate units and generally labeled for cans/bottles and newspaper. There are three recycling station locations within public spaces in the non-sterile and sterile areas: in the holdroom area near the concessionaire (Figure 9) and vending area (Figure 10), and in the public meeting area near baggage claim (Figure 11). Aluminum cans, plastic bottles, and paper are collected at these stations.

Figure 9 - Recycling station and waste bin in sterile holdroom area, near concessionaire

Figure 10 - Recycling station in sterile area near holdroom vending area

Figure 11 - Recycling for paper near concessionaire in the public meeting area

At the curbside terminal entrances, there are large garbage cans with large, square openings (Figure 12).

Figure 12 - Curbside garbage can

The terminal restrooms feature paper towel dispensers and air hand dryers (Figure 13), with garbage cans positioned near the door and small bins located in each toilet stall.

Figure 13 - Terminal restrooms offer both hand dryers and paper towel dispensers

Drinking fountains are available near the restrooms throughout the terminal (Figure 14). There are vending machines are located in both the non-sterile (Figure 15 and Figure 16) and sterile areas (previously shown in Figure 10).

Figure 14 - Drinking fountains in sterile area

Figure 15 - Vending machine in public meeting area

Figure 16 - Vending machines in non-sterile area

The concessionaire areas have small trash cans near the register, and retail employees may use the terminal recycling stations for paper, plastic bottles, cans, and glass.

In the airport administration offices, the conference room has two green recycling bins labeled for paper. There are small trash cans located at each desk. There are centralized recycling locations in the copy room and break room; these bins are for recycling paper, plastic, glass, and cans (Figures 17 and 18).

Figure 17 - Paper recycling bin in conference room

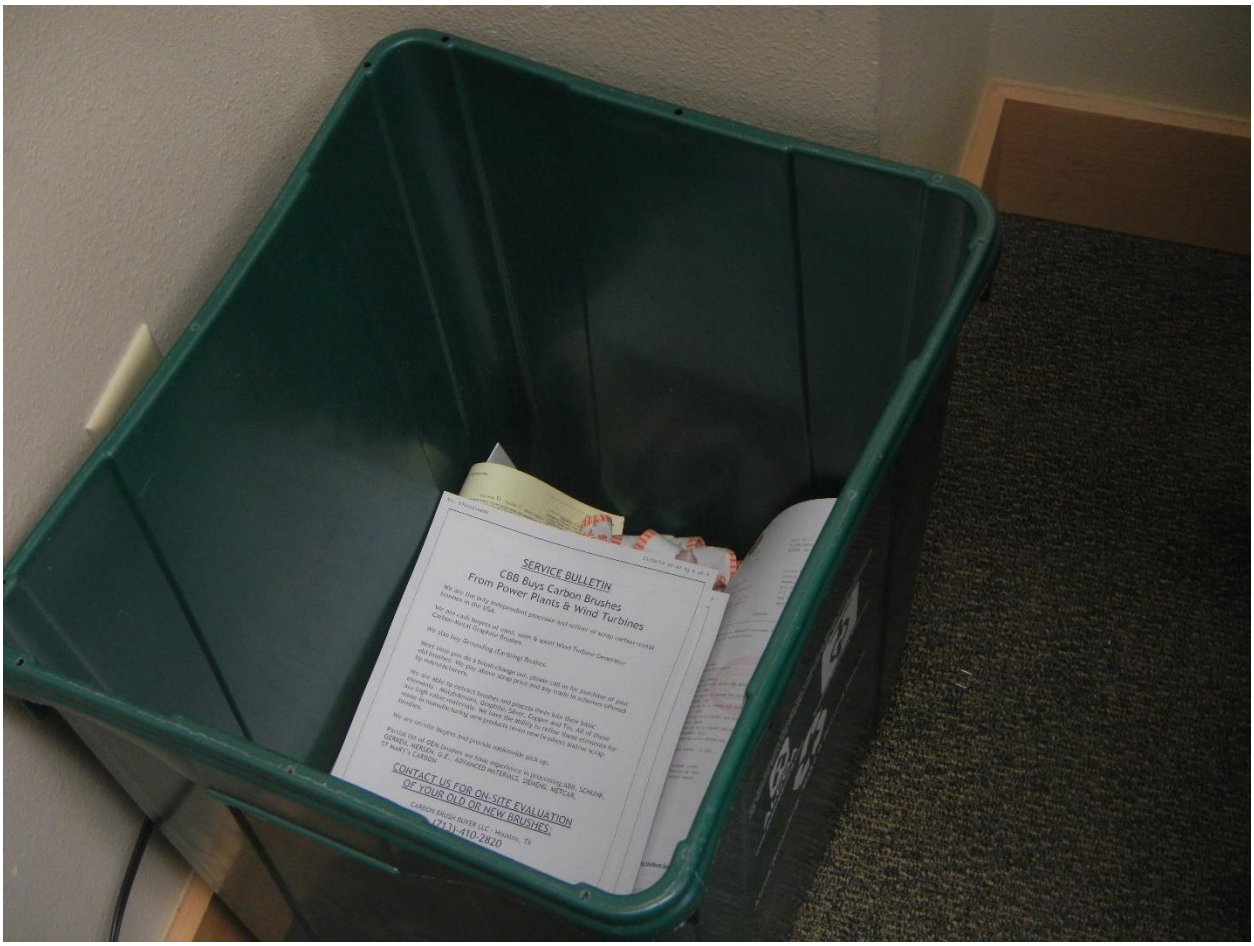

SERVICE BULLETIN
CBB Buys Carbon Brushes
From Power Plants & Wind Turbines
CONTACT US FOR ON-SITE EVALUATION
OF YOUR OLD OR NEW BRUSHES.

Figure 18 - Conference room recycling bin labeled for cans and plastics

A Waste Management single sort recycling poster is also displayed in the conference room.

Figure 19 - Waste Management single sort recycling poster in conference room

Single-Sort Recycling Service
This means you can put all your recyclables together, no sorting needed! Use your green cart with the yellow lid to place all your standard recyclables together. Place your carts at the curb no earlier than sundown on the day before collection or no later than 6:00 a.m. the day of collection. Recycling will be collected every other week. Watch for the recycling route pickup calendar to be mailed in March to all recycling participants. After collection, all carts should be removed no later than the evening of your collection day.
Chipboard and Boxboard
Like empty cereal and cracker boxes
Brown Paper Bags
Newspapers
Paper Cardboard, Dairy and Juice Containers
Junk Mail
Including envelopes
Glass Bottles and Jars
Office and School Paper
Cardboard Collapse boxes/cut large boxes down to 3'x3'
Plastic Bottles and Containers #1-#7
Return plastic bags to retail store collections
Aluminum Foil and Cans
Tin or Steel Cans
Items that cannot be recycled.
Candy wrappers
Carbon paper
Cloth
Food-soiled cardboard
Food or any organic waste
Liquids
Plastic bags and clear plastic wrap
Plates and dishes
Polystyrene (foam cups/plates)
Used paper cups and paper plates
Used paper towels and tissues
Waxed cardboard and paper
For container information, please contact
Waste Management 1-888-960-0008
wmeservice@wm.com
For billing questions contact:
City of Bismarck Service Operations
(701) 355-1700 recycling@nd.gov
Bismarck
WM
WASTE MANAGEMENT
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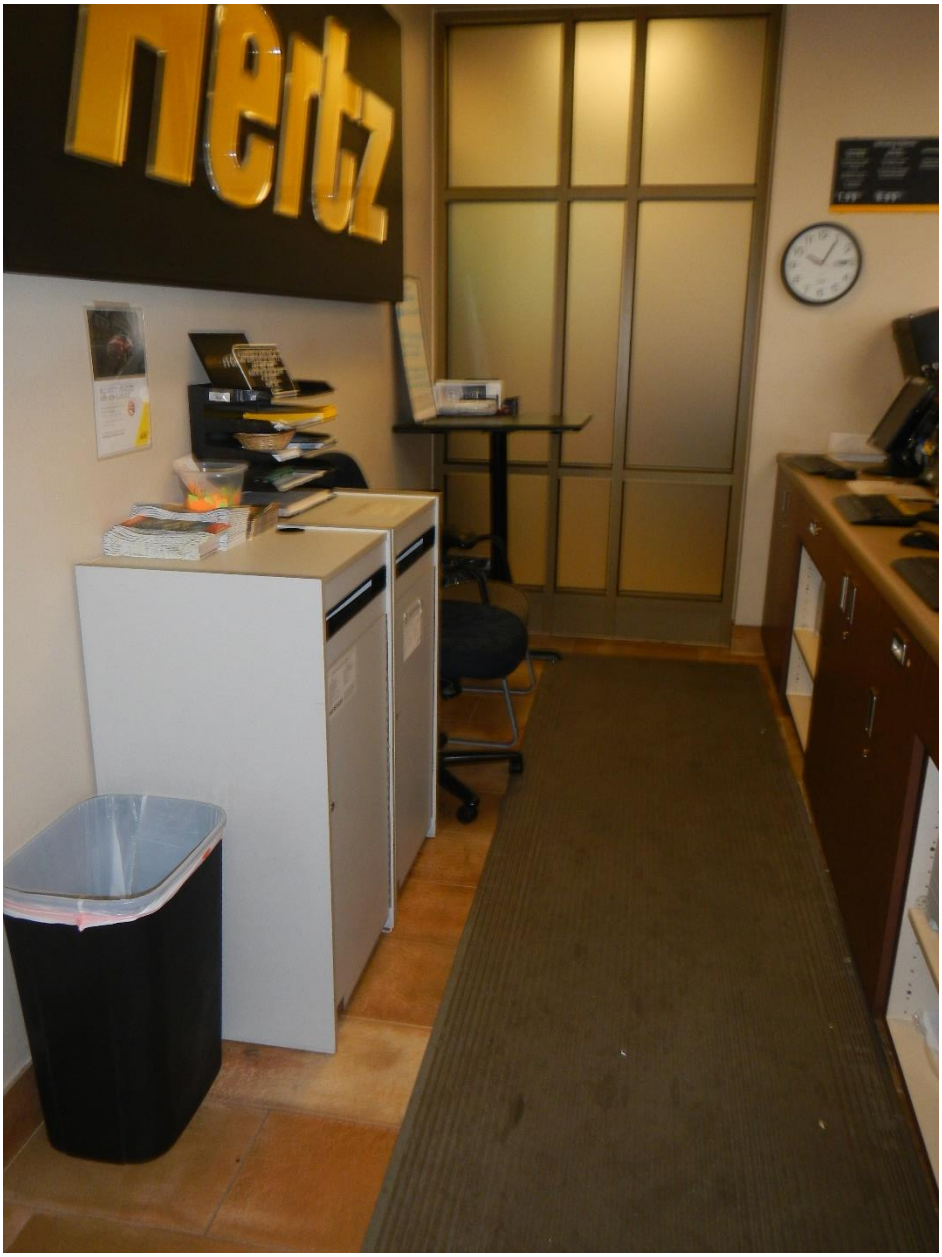
The rental car counters have small trash cans and lock boxes for collection of paper for shredding (Figure 20). Some rental car employees use the terminal recycling stations for plastic bottles, cans, and glass.

Figure 20 – Paper recycling bins behind car rental counter



Airline offices have a variety of smaller garbage cans located throughout the spaces (Figures 21 and 22); airline offices do not have recycling stations, but some airline employees use the recycling containers in the terminal or baggage make up areas.

Figure 21 – Garbage cans in airline office area

Figure 22 – Small garbage can under desk in airline office area

The ticketing counters have small trash cans at each counter (Figure 23).

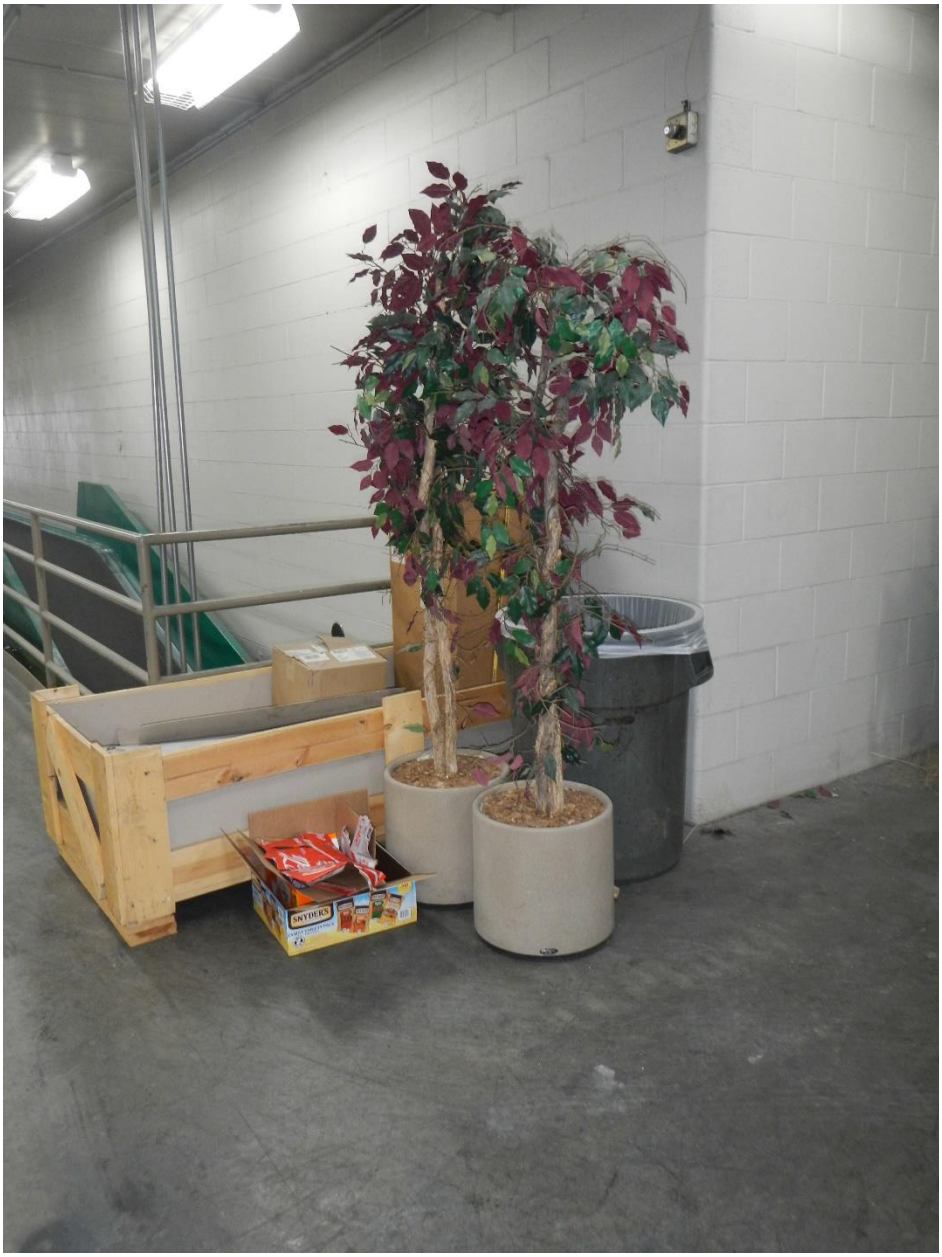
Figure 23 - Airline ticketing counters with trash cans

A variety of garbage cans and recycling bins are located throughout Airport maintenance support areas of the terminal. Containers in these areas vary in size, type and labeling. A terminal maintenance room has a tall metal trash bin that is lined (Figure 24). Large metal and plastic trash cans are found in several locations of the baggage makeup area (Figure 25 and Figure 26).

Figure 24 - Metal garbage bin in terminal maintenance area

Figure 25 - Garbage cans in corner of baggage makeup area

Figure 26 - Garbage can in Airport storage area



Also in the airline baggage makeup area, which is a space shared by all the airlines, there is a bin that is labeled for recycling plastic and glass bottles (Figure 27 and Figure 28). Aluminum cans are collected separately in this area for return at a local redemption center.

Figure 27 - Recycling bin and signage in baggage makeup area

Figure 28 - Recycling bin and container for dirty mop heads in baggage makeup area

At the Maintenance/SRE building, there are several garbage cans, including in the breakroom (Figure 29) and the maintenance shop (Figure 30 and Figure 31). Coffee containers are collected for reuse and stored in the maintenance building (Figure 32). There are no recycling stations in the Maintenance/SRE building. Some Airport staff haul recyclables from the Maintenance/SRE building to passenger terminal. There is space for a recycling dumpster outside of this facility.

Figure 29 - Garbage can in maintenance building break room

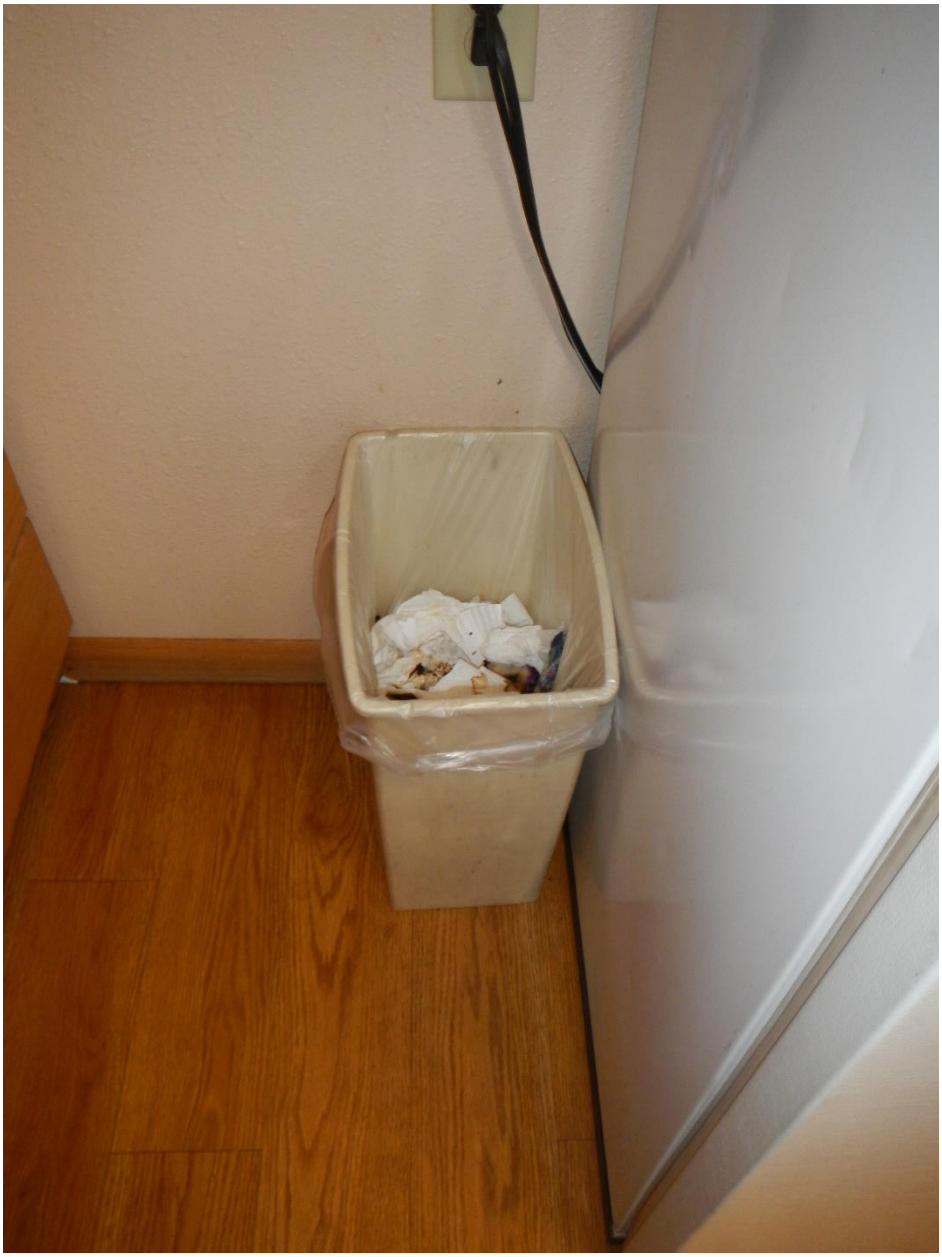


Figure 30 - Garbage can in maintenance shop

Figure 31 - Additional garbage cans in maintenance shop

Figure 32 - Collected empty coffee ground containers in maintenance building

The ARFF facility has a trash can in the kitchen (Figure 33) and another waste dumpster outside of the building (Figure 34). There is no recycling in the ARFF facility, but some ARFF staff haul recyclables to passenger terminal. There may be space for a recycling dumpster outside the ARFF facility.

Figure 33 - Garbage cans in ARFF building kitchen

Labels on recycling stations throughout the terminal and on the bins in the administration offices are the primary method for conveying messages about and instructions for recycling. These recycling station labels found throughout the terminal are not uniform in size, shape, or typeface. The square metal recycling stations found in public areas are generally labeled for “newspaper” and “cans/bottles”. Labeling on the green plastic recycling bin near the pre-security concessionaire is labeled “paper”. The labeling on the green plastic recycling bins for paper and other recycling throughout the employee areas throughout the terminal also varies. These bins are labeled “plastic or glass bottles only”, “plastics”, and “paper”. The only single-sort recycling graphic depicting accepted recyclables was found in the conference room.

Figure 34 - Waste dumpster outside ARFF building

There is a six-yard trash dumpster in the GA area; however, there is no recycling.

There are three six-yard trash dumpsters are positioned next to the terminal (airside). There is also one four-yard recycling dumpster in this area.

A single stream recycling dumpster (Figure 35) and three waste dumpsters (Figure 36) are located within a fenced-in landside area next to the terminal. Waste Management, the waste and recycling hauler, provides these containers. Access to the enclosure is restricted to employees, tenants, and contractors with airside access. Waste Management uses its own vehicles to collect and transfer.

The FBO terminals each have their own small dumpster and waste management contracts, separate from BIS. The FBOs do not have dumpsters for recycling and do not appear to be recycling materials.

Figure 35 - Airport dumpsters within landside area

Figure 36 – Waste dumpsters within fenced enclosure near terminal

D. Operation and Maintenance Requirements / Roles and Responsibilities

BIS's recycling program is maintained by facilities staff, with support from Airport management personnel.

The Airport Maintenance Manager is primarily responsible for the recycling program, including directing housekeeping activities, adjusting the program, purchasing custodial supplies, and communicating with BIS's business coordinator about collection services.

Airport facilities staff are responsible for custodial activities in specific buildings and areas, including collecting waste and recyclables from cans and bins and transferring these materials to the appropriate dumpsters. Airport facilities staff are responsible for custodial activities:

- in public spaces of the terminal
- in TSA areas
- in Airport Administration offices
- in the SRE building
- in the ARFF building
- in other Airport spaces
- on the airfield.

The Airport's terminal tenants (concessionaires, rental car companies, and airlines) and tenants in some of the outlying buildings (FBOs, FAA, and Army National Guard) are responsible for custodial activities in their areas, including transferring waste to the appropriate dumpsters. The operators of the FBO, and other buildings separate from the terminal are each responsible for securing their own waste and recycling services.

The Assistant Airport Director is responsible for communicating with the collection service providers and tracking program invoices. The Assistant Airport Director is responsible for supporting the program through allocation of resources (financial and other) and for coordinating tenant leases.

Waste Management is contracted through the City of Bismarck and is the primary waste and recycling hauling contractor for BIS. Materials are transported for disposal at the City of Bismarck Landfill. Recyclable materials (comingled paper, plastic, and aluminum, glass, and cardboard) are collected weekly and transported to a recycling facility at the landfill where they are sorted, compressed into bales, marketed, and sold. The landfill is approximately seven miles northeast of the Airport in an eastern outlying area of Bismarck.

The Airport is also serviced by ShredIt for the collection and recycling of shredded paper. The City of Bismarck accepts specific yard waste items (grass clippings, tree leaves, weeds, and twigs) for composting and sells compost to the public. The City does not accept tree branches or food scraps with yard waste. The area does not appear to have a commercial food waste compost facility.

E. Current Waste Reduction, Reuse, and Recycling Efforts

Waste Reduction

Also called waste minimization, waste reduction refers to reducing the volume of waste produced at its source. This can be accomplished through changing habits and practices, such as printing and purchasing. BIS currently employs the following practices to reduce the total amount of waste generated:

- Double sided printing in administration offices
- Email and internal websites for inter-office communication
- Shared drives for storage of documents
- On-screen print preview and PDF printer or other electronic printing
- Outsourcing large print jobs.

Reuse

In a waste management context, reuse refers to using materials and items more than once and as many times as possible before disposal. Reuse can include using items and materials for the original purpose or repurposing for a different use. Reuse can require purchasing durable materials and items instead of disposable or single use options.

The Airport currently reuses:

- Ceramic coffee mugs, reusable tumblers and water bottles, and durable silverware, plates, bowls, and cups (instead of plastic, paper, or Styrofoam) in Administration breakroom
- Empty plastic coffee containers for miscellaneous uses related to maintenance
- Office supplies, including inter-office envelopes
- Towels/rags in maintenance areas
- Office furniture

Recycling

Using the infrastructure and resources described above, BIS currently recycles one stream made up of several materials: cardboard; and comingled paper, plastic bottles, glass, and aluminum cans.

Terminal tenants generate most of the cardboard in the form of shipping boxes. The paper stream includes printer paper, mail, envelopes, and other paper from the Airport Administration offices as well as paper items, such as newspapers and magazines, collected in the public areas of the passenger terminal. The plastic, aluminum, and glass portions are primarily made up of beverage containers, collected from the public areas of the passenger terminal as well as the administration offices and restaurant.

Construction and Demolition Debris, Green Waste, and Other Waste

The Airport reuses and recycles the waste generated during construction projects where possible. Green waste generated from the maintenance of the property is managed on-site where possible. The Airport collects universal and hazardous waste; used oil and filters; batteries; paint; used tires; and scrap metal for beneficial reuse, recycling, or return to supplier programs.

Tenant Efforts

In addition to the recycling program operated by BIS, tenants at the Airport may be recycling on their own. In some instances, these tenants may be using the Airport's bins and dumpsters. Some tenants may be recycling; however, no recycling dumpsters other than those used by the Airport were observed during the site visit.

F. Tracking and Performance

The Airport does not currently track overall waste generation, recycled material volume, or other metrics. At present, BIS does not have specific waste or recycling objectives, targets, or goals.

3. Waste Audit

BIS staff provided information about:

- airport buildings and facilities
- areas that generate waste
- the types of waste generated in each area
- the materials that can be recycled under the current program.

Facilities staff have informally observed passenger and employee waste and recycling behaviors and, for this document, described generally how waste flows through the facility. The staff also described waste and recycling collection and hauling practices.

The consultant evaluated Airport information and records as well as aviation industry waste and recycling trends to identify the source, composition, and quantity of waste generated at BIS, including areas under BIS's direct control or influence. The consultant then used this information to identify opportunities to improve and monitor program effectiveness.

A. Quantity and Sources

Based on the observations during the site visit, the Airport has the three six-yard waste dumpsters with a capacity of 18 yards that are serviced by Waste Management who collects every week. Assuming a load factor of 75 percent and based on conversion factors from the EPA, each load is estimated to contain 13.5 cubic yards or 1.2 tons of municipal solid waste each collection. This totals approximately 60 tons a year.

Based on a 75 percent load factor and conversion factors from the EPA, the consultant estimated that BIS recycles approximately 350 pounds of commingled recyclables each week. This totals approximately nine tons a year.
Based on industry averages, the overall contribution of waste and recyclables from various areas and activities at BIS is likely similar to the distribution shown in Table 1.

Table 1 - Estimated Waste and Recycling Generation at BIS by Area/Activity

BIS Area/Activity	Estimated Percent	Estimated Weight (in tons)
Deplaned	20%	14
Other Airline	24%	17
Administration	3%	2
Public Areas	35%	24
Concessions	18%	12
Total	**100%**	**69**

Based on the waste and recycling data provided above, the Airport generates approximately 60 tons of waste a year and 9 tons of recyclables a year. Therefore, the Airport's current recycling rate is about 13 percent. Based on this distribution, programs that focus on the airlines and public areas may represent the best opportunities to reduce waste generation and increase landfill diversion. A physical waste sort could provide more detailed information about the amount and proportion of waste generated in total and by each area, activity, and tenant.

B. Composition

Based on the activities taking place at BIS, a varied waste stream can be expected. According to industry case studies and previous waste planning projects, an airport's waste stream is approximately 40 percent recyclable, 35 percent compostable, and 25 percent waste that cannot be recycled or composted due to current technologies and, as a result, must be placed in a landfill.

Table 2 lists each area included in the scope of this plan and the type(s) of waste likely generated there.

Table 2 - Bismarck Municipal Airport Waste by Area and Material

Bismarck Municipal Airport Waste by Area and Material																		
Area | Material	Office Paper	Newspapers	Magazines	Plastic	Aluminum	Cardboard	Glass	Food Waste	Paper Products	Liquids	Toiletries	Packaging	Styrofoam	Metals	Deplaned Waste	Green / Yard Waste	Construction and Demolition	Other Waste
Airline Terminal Building																		
Public passenger areas Curbs, ticketing lobby, restrooms, security screening queuing area, sterile gate areas, public "meet and greet" spaces, baggage claim area		x	x	x	x			x	x	x	x	x						x
Tenant areas Concessionaires and associated activities	x	x	x	x	x	x	x	x	x	x		x						x
Airline areas Offices, ticketing counters, gate stations, breakrooms, underwing services, and deplaned waste	x	x	x	x	x	x		x	x	x		x			x			x
Rental Car areas Offices, counters, return areas, service areas, breakrooms	x			x	x			x	x	x								x
TSA Spaces	x	x	x	X	X			x	x	x	x	x						x
Airport Administration Offices	x	x	x	x	x	x		x	x			x						x
ARFF Building	x	x	x	x	x	x	x	x	x			x						
SRE/Maintenance Building	x	x	x	x	x	x		x	x						x	x	x	x
Airport Maintenance Activities															x	x	x	x

A physical waste sort could provide more detailed information about the specific composition of waste at BIS. This information may include:

- the types of items included in each general category
- the contamination rate of the recycling stream (items that are not recyclable in the recycling bins)
- the recovery rate for recycling (the proportion of recyclable items that are segregated properly).

The data from a waste audit can also be used to identify opportunities to improve the composition of the waste stream (for example, by item substitution or by improving recycling to reduce the volume of waste).

The following sections describe in more detail some of the waste and recyclable materials generated at an airport like BIS: toiletries, food and beverages at security screening, and liquids throughout the facility.

Toiletries, Food, and Beverages - TSA Restrictions

The TSA restricts the volume of liquids, gels, and aerosols that can be carried onto an aircraft. Passengers are allowed three-ounce containers of toiletries in a one-quart baggie (3-1-1) in their carry-on luggage. Even though these restrictions have been in place for longer than 10 years, toiletries, beverages, and food items that do not meet the requirements are regularly found in passenger luggage during security screening.

When these items are found, the TSA gives passengers three options: pack the item in a checked bag, give the item to a non-traveling family member or friend, or forfeit the item. By law, the TSA cannot retain any items removed from passenger luggage, so items that are not repacked or handed off end up in the trash. In addition, when a restricted item is discovered in a passenger's carry-on or bag, the passenger may be subject to additional screening, which requires extra time and can interrupt the flow at a security screening checkpoint.

Items that end up in the trash at security checkpoints include: bottled water, other bottled or canned beverages, toothpaste (larger than travel size), shampoo and/or conditioner (larger than three ounces), sunscreen, and aloe gel. Some other, less obvious unallowable items are peanut butter, yogurt, applesauce, and maple syrup.

It is expected that the garbage cans and recycling station located in the security queuing area receive a fair amount of liquids and beverage containers due to TSA restrictions. These items end up in the waste stream where the liquids are difficult to manage, and the containers cannot be recycled. Liquids add significant weight to the waste stream, contaminate other materials such as paper, and may be rejected by a recycler, which can result in them being taken to the landfill.

Liquids

Liquids contaminate and degrade other materials within the recycling stream and add weight to recycling or waste streams where they are found. In some cases, liquids are thrown away in their containers, which means the recyclable material found in water bottles, aluminum soda cans, and plastic beverage containers is not captured for recycling.

C. Purchases

The Airport does not currently track the quantity and type of disposable items and supplies purchased for the facility. This information could provide insight on some of the materials coming into the Airport which will go back out as waste (other materials are brought on-site by passengers, employees, and vendors). The purchase list may include:

- items that have reusable or recyclable alternatives (foam cups)
- some items which could be eliminated (by converting paper forms to digital to reduce paper waste generated)
- some which indicate scale of the activity at the Airport (paper towel and garbage bags).

4. Review of Waste Management Contracts

As noted in Section 1, the FMRA lists the review of waste management contracts as an element of addressing solid waste recycling at an airport. The FAA memorandum titled "Guidance on Airport Recycling, Reuse, and Waste Reduction Plans" explains that the purpose of reviewing these contracts is to "identify opportunities for improving (waste) program scope and efficiency, as well as identify constraints."

In general, the Airport's contracts and leases address housekeeping requirements and related expectations for managing trash and provide limited information about recycling. These contracts and leases do not necessarily impede recycling or other waste management strategies; however, they do not explicitly require conformance with or support of the Airport's recycling and related efforts. The following sections describe the content of various Airport contracts related to waste and recycling.

A. Custodial and Waste Hauling Contracts

BIS does not contract for custodial services for the areas under airport control; these areas are maintained by City employees.

The City has an exclusive franchise agreement with Waste Management for the collection of waste and recyclable materials. The City's solid waste franchise agreement outlines the responsibilities of the collection contractor, including:

- Collect garbage, rubbish, or other solid waste from…locations other than residences and city facilities
- Convey such material to the city landfill.

B. Tenant Leases and Service Contracts

The Airport has individual leases with each of its tenants and, in general, these agreements do not include specifics pertaining to waste management or recycling. Among the sample of tenant lease agreements that were reviewed for this project, only some include basic requirements pertaining to trash removal and janitorial activities in leased areas. All the lease agreements that were reviewed require the tenants to perform general maintenance including cleaning and keeping the property clean and orderly, but some of these agreements do not specify which party is responsible for trash removal. The City's lease agreements with American Airlines, LSLCO LLC (café/gift shop) and Enterprise note that the City is to provide trash removal services.

The City's agreement with American Airlines notes that the City will provide janitorial services, including trash removal, in the Airlines Preferential Space. The City's agreement with LSLCO notes that the airport will provide two trash receptacles as well as trash pickup and disposal from central locations with such locations designated by the Airport Manager. It also specifies that LSLCO is responsible for janitorial services within their leased space. The lease agreement with Enterprise notes that the City provides trash pickup and disposal from central locations with such locations designated by the Airport Manager. It also notes that Enterprise shall use its own janitorial supplies and keep the leased space clean and orderly. None of the lease agreements that were reviewed describe the Airport's recycling program and practices or discuss the use of recycled products.

While the TSA lease agreement was not available to review, it is assumed that it is a standard U.S. Government Lease for Real Property leased space at the Airport for use by the TSA. TSA lease agreements typically outline the services which are to be provided by the Airport, including trash removal and janitorial service and supplies. TSA lease agreements often outline other requirements including:

- cleaning to be completed during Airport hours
- rent to be adjusted annually based on actual janitorial costs
- the Airport to maintain the area in a clean condition and provide supplies and equipment
- daily emptying of trash receptacles, disposal of trash and garbage, and cleaning of cans used for collection of waste.

C. Expiring Leases and Contracts

Specific information regarding the expiration, extension and/or renewal dates of the Airport's numerous leases was not reviewed under this project. As outlined in the FAA guidance memo, "this information can signal the Airport's next opportunity to add recycling, reuse, and waste reduction objectives to existing leases and contracts."

D. Funding

Waste and recycling collection are funded in BIS's operating budget. BIS does not currently receive payment or rebates for recycled materials.

5. Recycling Feasibility

Many factors impact the feasibility of recycling at BIS; some are universal, and others, specific to the facility. The following sections describe the more influential of these factors.

A. Commitment and Support

The willingness of BIS and its contractors and tenants to commit to and support the facility's recycling program are critical to the success of such a program. Without the commitment of resources such as funding, labor and time, space, and access to secure areas, a waste management program could struggle.

Airport Policy and Contractor Dedication

BIS's administration has supported the recycling program in the past, and it is expected that this will continue in the foreseeable future. Based on the resources allocated to these programs, the Airport Committee and City of Bismarck appear to generally support recycling, practical waste management, and sustainable operations.

The mission of the City's Solid Waste Utility is to provide high-quality solid waste collection and disposal services in a timely and effective manner to promote the safety and welfare of the City residents. The mission of Waste Management is to provide efficient, easy, and sustainable solutions that help customers reduce, reuse, and recycle. This commitment aligns with continued support of the Airport's recycling programs.

Airline Policies

All five airlines that operate at BIS have established sustainability programs that include elements of waste and recycling. At least one of the airlines serving BIS separates and recycles materials deplaned from commercial service flights.

American Airlines has implemented recycling programs on the ground and in the skies. American recycles in back offices and breakrooms at their major hub at Dallas/Fort Worth International Airport, at maintenance centers, and in other offices/employee work areas. According to their website, the airline introduced the industry's first onboard recycling program and recycles aluminum cans, paper, and plastic in-flight.

Per corporate policy, Delta is "committed to minimizing waste streams through diversion and re-use, waste, recycling programs, and (waste reduction)." Delta has been working to increase the number of cities where they recycle, and the volume of material collected. In addition, they track employee recycling at the headquarters campus in Atlanta and upcycle life vests, carpet, and leather seat covers.

Aboard Delta flights, single stream materials, including plastic, aluminum, and paper, are collected by flight attendants in designated bags. These materials are collected by cabin service and transported to designated recycling containers. Empty cans and bottles left in the beverage carts are recycled by Delta's catering partners.

United Airlines is "committed to operating sustainably and responsibly" and has recycled over 28 million pounds of aluminum cans, paper, and plastic from flights and facilities. In 2014, United began to replace its hot beverage cups with fully recyclable alternatives made from recycled plastic water bottles.

Offering recycling for deplaned waste at BIS aligns the Airport with its airline partners.

B. Technical and Economic Factors

Local Markets and Infrastructure

Markets for recycled materials fluctuate widely based on many factors and interactions. Local waste haulers typically accept materials that can be recycled cost-effectively in the area. Manufacturers purchasing recycled material want it to be predictable and ready for use; therefore, recycling facilities are particular about what materials they accept and prefer materials that are of high value and clean and easy to separate.

The materials listed in Table 3 are accepted under the City's residential recycling program; an accepted items list was not available for the City's commercial program. As noted above, inclusion in such programs typically indicates that the market and/or infrastructure for these materials is strong. BIS currently recycles all the materials the City's commercial recycling program accepts.

Table 3 - Materials Accepted for Residential Curbside Recycling in the City of Bismarck

Recyclable Materials – City of Bismarck Residential Program
Cardboard
Tin and aluminum
Plastic bottles, tubs, and jugs
Mixed paper, newspaper, magazines
Glass

Source: City of Bismarck Garbage & Recycling website https://www.bismarcknd.gov/DocumentCenter/View/20925/Single-Sort-Materials-accepted-and-unacceptable?bidId=.

The City of Bismarck operates one landfill and nine recycling drop-off locations in Bismarck. The recycling drop-off locations are for residential use only.

Logistical Considerations and Constraints

To maintain a recycling program at BIS, certain elements must be in place. These include:

- a proactive and engaged custodial staff
- a willing and affordable hauling contractor
- space for bins and dumpsters
- access to secure areas of the facility (including airside aprons and sterile terminal areas).

At this time, these elements appear unconstrained; additional resources including custodial labor, waste hauling services, space, and airport access are anticipated to be available to support the continuation and/or expansion of the recycling program at BIS.

Contractual Issues

A detailed evaluation of the Airport's contracts is included in Section 4. Any major contractual issues with maintaining and improving the recycling program at BIS are not anticipated. BIS and the waste and recycling collection contractor will need to continue to collaborate to support the facility's recycling program.

C. Recycling, Landfill, and Energy-from-Waste Facility Requirements

The recycling facility and landfill that accept waste from BIS have specific acceptance criteria and requirements. Adherence to these specifications protects the safety of employees handling these materials; the integrity and operation of the equipment and infrastructure used to transfer, sort, and convert these materials; and the value of the recyclable stream.

Components that seem recyclable (plastic, glass, or metal parts) comprise some items generated at BIS; however, the recycling facility has specific material standards, so it is important that non-recyclable items are not included in the facility's recycling stream. Waste items that may be generated at the Airport, but are prohibited at the recycling facility include:

- Styrofoam
- Plastic bags
- Saran wrap
- Frozen food packaging
- Plastic clamshells
- Bakery containers
- Paper/plastic plates
- Paper napkins
- Paper/plastic cups
- Waxed cardboard
- Plastic lids and caps
- Liquid in container
- Lightbulbs
- Batteries
- Unnumbered plastic
- Other garbage

Waste material that may be generated at BIS but is prohibited by the City of Bismarck's Landfill includes hazardous waste, radioactive waste, large batteries, paint, and C&D waste.

Some waste items cannot be recycled or taken to the landfill, for example hazardous waste and chemicals, paint, batteries, and C&D waste. These items must be managed through hazardous waste or universal waste programs or disposed of at a specialized landfill.

Costs

BIS strives to be as self-sustaining as feasible; therefore, it is imperative that programs implemented and maintained at the facility, including recycling, are as cost-effective as possible.

D. Guidelines and Policies

To evaluate BIS's existing recycling plan in the context of local, state, and national requirements, the consultant reviewed federal, State of North Dakota, and local waste and recycling regulations and policies/factors.

Federal

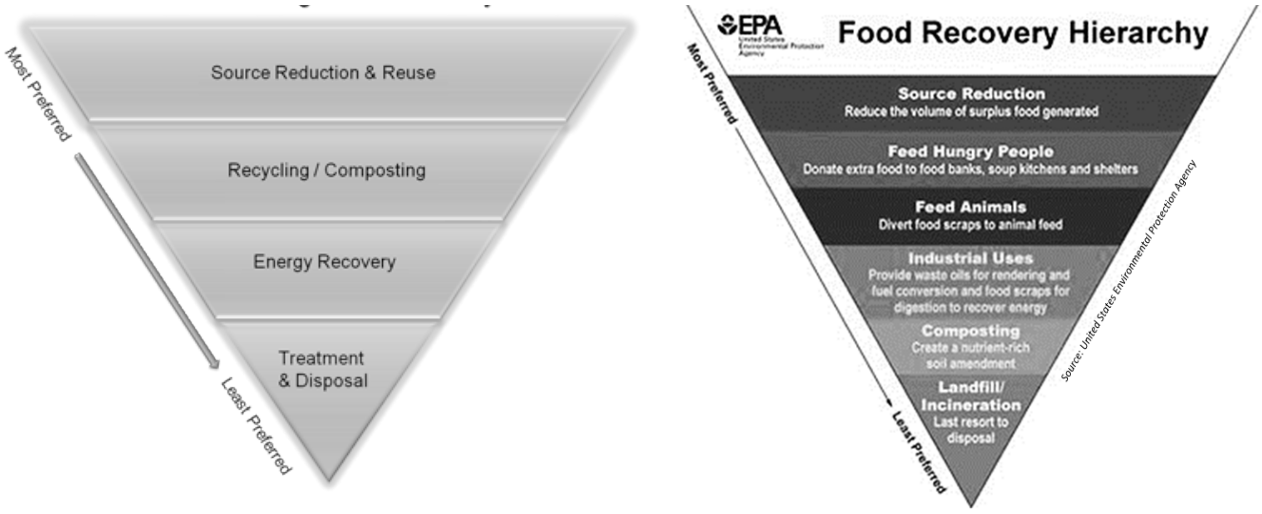
At the federal level, the United States Environmental Protection Agency (EPA) is responsible for developing a solid waste management program under the Resource Conservation and Recovery Act (RCRA) and related policies and guidance. RCRA provides the framework for management of hazardous and non-hazardous waste. All generators of hazardous waste, including airports, are required to comply with RCRA and all other federal waste laws and regulations.

As described in Section 1, the FAA's definition of airport planning was updated in 2012 through FMRA to include planning for recycling and waste minimization. The Airport is required to address solid waste as part of airport master planning. The FAA provides guidance on airport waste and recycling in the September 2014 memo on the topic as well as in a synthesis document prepared in 2013 (both available on the FAA's website).

The EPA has developed a hierarchy of waste management strategies. This hierarchy, shown below, ranks these strategies from most- to least-environmentally preferred and places emphasis on reducing, reusing, and recycling.

In addition to the general waste management hierarchy, the EPA has also developed a preference ranking of management strategies for food waste, as shown below.

Figure 37 – Waste Management Hierarchy and Food Recovery Hierarchy



Waste Management Hierarchy (left) and Food Recovery Hierarchy (right)
Source: United States Environmental Protection Agency

State

At the state level, the North Dakota Department of Health Division of Waste Management oversees waste management and recycling. The State encourages waste minimization, reuse, and recycling but does not require municipalities to offer residential programs or businesses to recycle. The State's most recent waste management plan was finalized in 1993.

Local

While the City of Bismarck has contracted with Waste Management, Inc. for the collection of recyclable material through curbside recycling and recycling drop site locations, it is the only capital city in the country that doesn't employ some form of required recycling program. A major component of the City's current recycling program is cooperation and willingness to participate among citizens.

E. Other Incentives

As noted earlier in Section 5, most of the airlines serving BIS have recycling programs and targets. Aligning the BIS program with the airlines' practices provides the opportunity for a win-win scenario whereby the facility can reduce its environmental impact and, by helping the airlines reduce their impacts, generate goodwill with the airlines.

6. Cost Savings or Revenue Generation

The costs associated with a recycling program depend on available infrastructure, material markets, and the type of waste generated at a facility. These costs sometimes include capital costs for containers, landfill tipping fees, hauling costs, material rebates, and labor. An evaluation of the potential cost savings and revenue generation opportunities is required for an Airport Recycling, Reuse, and Waste Reduction Plan according to FMRA.

Data pertaining to waste and recycling costs was not provided for review under this project. The amount spent on collection of waste from the terminal, Maintenance/SRE building, ARFF building and airfield each year is unknown. To estimate annual costs for recycling, information about the charges associated with the collection of the recycling dumpster and other services is needed.

After supplementing the information compiled and analyzed in this document, BIS can make informed solid waste management decisions over time. The Airport could use cost information to identify potential cost savings or prioritize strategies to reduce costs. Using the information provided in this plan and available cost information, BIS can begin to analyze the program's financials, evaluate costs, and determine if enhancements should be implemented. If expansion of the program is not technically or economically feasible at this time, this information will help BIS determine when improvements might become feasible.

7. Recommendations

This section documents recommendations for the Airport, including waste reduction, reuse, and recycling strategies, based on the information presented earlier, specifically the waste audit and feasibility discussion.

A. Objectives and Targets

Set SMART Goals.

It is recommended that the Airport set specific, measurable, achievable, realistic, and time-bound (SMART) goals for its waste and recycling program. Having an established set of objectives and targets provides a basis and foundation for subsequent activities and actions. Progress toward such goals does require tracking, but can also provide information on progress and improvements, which can be a valuable marketing and education tool.

The waste source, quantity, and composition information in Section 3 provides baseline data for establishing objectives and targets, and Section 5 describes the goal and target established by the State of North Dakota. The objectives and targets derived from this information can be used to calculate target levels for BIS. A physical material sort would further inform goal-setting efforts.

These are potential objectives and targets BIS might adopt or use as inspiration for other goals:

- Recycle 22 percent of waste stream by 2028 (See Section 3B, current rate is approximately 12 percent, one percent improvement each year)
- Hold annual meetings with stakeholders to evaluate and improve recycling program
- Install one liquid collection station at the security checkpoint (more details in Section 7C)
- 100 percent of tenants recycling at least one material
- 100 percent of BIS employees complete simple training on recycling program (more details later in this section)

In the absence of established specific objectives and targets, the following sections present general, universal recommendations for increasing recycling and reducing waste generation at an airport like BIS.

B. Tracking and Reporting

Estimate and Track Key Metrics.

As noted in Section 2, BIS does not currently track metrics associated with the waste management program. It is recommended that BIS begin to regularly estimate and track the volume of waste sent to the landfill and the volume of material collected for recycling as well as the costs associated with these services.

Assess Trends.

By tracking costs associated with waste and recycling, BIS can begin to identify trends associated with waste generation, landfill, recycling, and cost can be assessed for issues or opportunities for improvement.

Establish Reporting Schedule and Proactively Provide Information About Program.

BIS's waste and recycling performance is not currently reported to stakeholders. It is recommended that BIS proactively provide this information to management, employees, tenants, and interested external stakeholders on a regular basis. The purposes of this reporting are:

- to remind management employees, tenants, and contractors about the recycling program
- to communicate the Airport's commitment to its recycling program and its broader commitment to sustainability
- to solicit feedback and suggestions for improving the recycling program.

The frequency of reporting is up to the Airport, but it is recommended that reporting be completed at least annually. The reporting schedule should also be updated as needed to accommodate changes to the program. The schedule is expected to initially increase in frequency as the program evolves and new strategies are implemented, and then potentially return to a lesser frequency as the program is maintained.

C. Reduce and Reuse

Substitute Disposable Items with Durable Alternatives and Reuse Items and Materials

To reduce the its environmental impacts, BIS should focus on moving materials up the waste management hierarchy. Waste reduction is the most environmentally preferred waste management strategy as determined by the EPA.

Waste reduction can be accomplished in many ways, including reusing items.

It is recommended that the Airport evaluate the following reduction and reuse strategies to determine which, if any, are feasible and prudent for implantation at BIS.

- Substituting disposable items with durable alternatives in the administration office and other staff work areas
- Reusing items and materials where possible
- Working with the concessionaire tenants to donate edible food to a community food security organization

- Collecting and donating unopened food, beverage, and toiletry items subject to TSA restrictions
- Identifying opportunities to encourage waste reduction by passengers, tenants, and contractors.

Promote and Facilitate Bottle Emptying and Refilling.

It is expected that the garbage can located in the security queuing area receives a fair amount of liquids and beverage containers due to TSA restrictions. Unfortunately, when these materials end up in the waste stream, the liquids are difficult to manage, and the containers cannot be recycled. Liquids add significant weight to the waste stream, contaminate other materials such as paper, and may be rejected by a recycler, which will result in them being landfilled., BIS could promote emptying of water bottles in the restroom sinks and refilling post security. Adding colorful, graphic signs in the terminal restrooms encourages passengers to empty water bottles prior security and to refill them after screening. Signage can be supplemented, for example, with vinyl cling decals on the mirrors over the sinks and posters or other visuals in the checkpoint queuing area.

In the future, these signs could be revised to also encourage passengers to recycle disposable water bottles if they do not wish to refill them. It is further recommended that BIS make a recycling station (collated to a trash can) available in the immediate proximity of the pre-security restrooms so that passengers who do empty their disposable containers in the sinks have a convenient place to recycle the items they do not wish to refill.

Liquid collection stations are becoming more common at Airports around the country to combat liquids in the waste and recycling streams. If liquids are an on-going issue at this location, it is recommended that the Airport consider installing one liquid collection station and recycling station in the security queuing area to capture the liquids that are discarded in the security checkpoint area.

Donate Food, Beverages and Toiletries.

It is recommended that BIS work with the food and beverage concessionaire to assess the possibility of donating edible food to a local food bank, soup kitchen, or shelter for distribution to the populations they serve. Feeding people is the second preferred strategy for addressing food waste according to the EPA. Federal and state laws protect organizations that donate food in good faith from liability. Some organizations will pick up food at the source which reduces the demand on the Airport and concessionaire.

It is also recommended that BIS investigate the feasibility of collecting unopened bottles of water, other beverages, food, and toiletries that are restricted from carry-on luggage and donating them to a local charity or other organization. These items can be very heavy and add weight to the waste stream.

In compliance with TSA requirements, these items may need to be collected prior to the security checkpoint queuing area. BIS would collect these items by locating a container at the security checkpoint and managing storage of the items until the receiving organization could collect them. To implement this recommendation, coordination between BIS, the designated receiving organization, and the TSA would be needed. An example of an Airport with such a program is McCarran International Airport in Las Vegas, Nevada.

Example Donation Collection at McCarran International Airport (LAS)

Provide Supplies, Fixtures, and Project Guidelines Which Encourage Reuse.

To reduce its volume of waste, BIS should encourage reuse by Airport employees, passengers, tenants, and contractors. BIS might encourage reuse by Airport employees by issuing reusable tumblers, water bottles or coffee mugs to BIS staff. Providing refill stations next to water fountains as part of fixture upgrade projects also helps to promote the use reusable beverage containers. To encourage reuse by passengers, some Airports have locations where discarded magazines and newspapers can be used by other passengers. It is also recommended that BIS specify that contractors must evaluate the potential to reuse existing pavements onsite as a base course for new pavement as part of future Airport construction projects.

D. Recycle and Compost

Recycling is the second preferred waste management strategy, according to the EPA, after waste reduction/reuse. Recycling allows waste items to be processed into raw materials to make new products. The FAA guidance expects an airport's recycling, reuse, and waste reduction plan to document, at a minimum, the facility's existing program to recycle paper, plastic bottles, aluminum cans, and plastic cups. The Airport recycles most of these materials as well as cardboard and glass.

Paper

Continue Paper Recycling.

The Airport is currently recycling paper (printer paper, mail, envelopes, and other items) collected from the administration offices as well as from the paper recycling stations in the terminal (newspapers and magazines). Paper may also be recycled from the other Airport buildings (Maintenance and ARFF) by employees who bring paper materials to the terminal to be recycled. Within the terminal, these paper streams are collected separately at bins and comingled with other recyclables at the dumpster. Shredded paper is collected and recycled separately. Managing recyclable paper separately from plastic bottles and aluminum cans protects the value of the paper stream and increases its recycling potential by minimizing contamination from liquids and creating a stream that may not need to be sorted. It is recommended that the Airport ask Waste Management about adding non-shredded office paper, newspapers, or magazines to the shredded paper collection.

Expand Paper Recycling Program.

It is also recommended that the Airport expand the program to additional areas, including the airline and rental car company offices, and encourage increased recycling of paper by employees, tenants, and passengers by placing additional paper recycling locations in high traffic areas. Doing so reduces the environmental impacts associated with landfilling this material and manufacturing virgin paper.

Waste magazines and newspapers are generated aboard commercial flights and when they expire on the newsstand; it is recommended that the Airport collaborate and coordinate with the airlines and concession tenant serving BIS to evaluate adding paper items from deplaned waste and newsstands to this program.

Plastic Bottles, Aluminum Cans, and Plastic Cups

Continue and Expand Plastic Bottle and Aluminum Can Recycling Program.

The Airport is currently recycling plastic bottles (including water bottles) and aluminum cans collected in the terminal. There is no formal recycling in the Maintenance/SRE and ARFF buildings, but some employees may bring recycling from these buildings to the terminal. Plastics are comingled with aluminum cans and collected and managed separately from paper products. It is recommended that the Airport expand the program to additional areas and encourage increased recycling of plastic bottles and aluminum cans by employees, tenants, and passengers to reduce the environmental impacts associated with landfilling this material and manufacturing virgin plastic.

Plastic bottles and aluminum cans are also generated aboard commercial flights; it is recommended that the Airport collaborate and coordinate with the airlines serving BIS to evaluate adding plastic bottles and aluminum cans from deplaned waste to this program.

Collaborate with Airlines to Add Plastic Cups to the Recycling Program.

Plastic cups are typically generated aboard commercial flights. It is recommended that the Airport collaborate and coordinate with the airlines serving BIS to evaluate adding plastic cups from deplaned waste to the recycling program.

Cardboard

Continue Cardboard Recycling Program.

The Airport currently recycles cardboard collected from the terminal concessionaire tenants and the administration offices. This material is collected separately and disposed of in the comingled recyclable stream dumpster. It is recommended that the Airport continue to recycle cardboard.

Provide Feedback to Tenants on Cardboard Recycling Program.

It is also recommended that BIS provide feedback to the tenants on the progress and performance of this program and solicit their feedback regarding improvements that could be made to increase or support their participation. Marketing this program to all the terminal tenants could result in additional participation and remind existing participants of the program's specific requirements.

Approach Waste Management About Potential to Protect Value of Cardboard Stream.

When cardboard is collected and managed separately from the comingled recyclable stream, it protects the value of the cardboard material by creating a single material stream (more desirable because it reduced contamination from liquids and requires less processing after collection). It is recommended that BIS approach Waste Management to discuss the potential for collecting and managing cardboard in a separate dumpster to protect the value of the material.

Glass

Continue Glass Recycling Program.

The Airport currently recycles glass collected from the terminal tenants, concessionaires, and passengers; however, very little glass is generated at BIS. This material is collected with the comingled recycling stream. It is recommended that the Airport continue to recycle glass.

BIS should approach Waste Management about the feasibility of collecting and managing glass separately from the comingled recyclable stream to protect the value of the other material by reducing contamination glass. It is also recommended that BIS provide feedback to the tenants on the progress and performance of this program and solicit their feedback regarding improvements that could be made to increase or support their participation.

Other Recyclables

As other recyclable materials are identified in BIS's waste stream, it is recommended that the Airport work with the waste hauling contractor to design and implement strategies to separate, collect, and process these materials.

Green Waste

Evaluate Implementing a Formal Green Waste Program.

It is recommended that the Airport evaluate how green waste is managed and explore opportunities to align the facility's practices with the waste hierarchy; for example, by reducing the generation of this material at the source (mulching lawnmowers), reusing material where possible (chipped branches as mulch), composting (via the local facility), and disposing of the material on or off site as a last resort.

Food Waste Composting

According to industry case studies, food waste is typically a major component of the waste stream at an Airport (on average, 35 percent). As described in Section 5, the EPA's food recovery hierarchy assigns priority to composting of food waste over landfill of this material (after using it to feed people as discussed under **Reduce and Reuse**). Composting is the process of decomposing food and other waste into a nutritious soil additive.

Implement a Food Composting when an Area Program is Established.

Composting of food waste at BIS is largely dependent on the availability of a local composting facility interested in accepting this material. As noted in Section 2, there does not appear to be a commercial composting facility in the area.

If a composting facility is found or established in the area, BIS should evaluate implementing composting at the Airport. In a terminal, pre-consumer food waste (waste generated by food preparation activities) is generally easier to compost because restaurant employees are at a facility more frequently and on a more regular basis than passengers, so they are easier to train and educate on composting practices and requirements.

The specific items accepted by a composting facility are dependent on that facility's design and the process used to break down the waste; some facilities accept all food waste (including meat and bones and breads) while others accept only vegetables and fruit.

One option for easing into composting gradually is to first implement a composting program for coffee grounds generated by restaurants in the terminal. Coffee grounds have a pleasant odor, are easily identifiable (therefore easy to separate), are typically uncontaminated by other materials, and are generated in a predicable manner and quantity. Once tenants are comfortable composting coffee grounds, other materials can be added by name (for example, banana peels or apple cores) and/or by type (fruits, vegetables, etc.) until all food waste appropriate for composting is included.

Paper Products

Implement Paper Composting When an Area Program is Established.

Once a commercial composting facility is available in the area, the Airport may wish to collect paper towels and other paper products (napkins and tissues) for composting. Composting is environmentally preferred over landfilling this material.

Because the Airport's restrooms are equipped with paper towel dispensers and nearby garbage cans, the waste stream collected in these cans will primarily consist of paper towel. This stream can be expected to contain low contamination and a steady volume of material, making it an attractive material for composting.

Besides moving the garbage bins closer to the paper towel dispensers, no modifications to the paper towel dispensers or garbage bins would be needed to implement paper towel composting. Alternative bins would need to be conveniently located and clearly labeled to accept other waste generated in the restrooms that is not paper towel, and the bins reserved for paper towel should be labeled "Paper Towel Only – Collected for Composting" (or similar) to instruct use and explain how this material is managed. The Airport would also need a dedicated cart for this material and a procedure to collect and store it separately until it was collected by the waste hauling contractor for delivery to the composting facility.

Energy from Waste

Utilize EfW Facility If One Is Established.

Converting waste into energy is environmentally preferred over landfilling, according to the EPA. There does not appear to be an active Energy-from-Waste (EfW) facility in the Bismarck area. It is recommended that the Airport utilize an EfW facility, if one is established in the area, for all waste materials that cannot be reused, donated, recycled, or composted and track this stream.

E. Education and Outreach

Under the existing program, education of and outreach to Airport employees, tenants, contractors and passengers is primarily accomplished through container signage in the terminal.

Improve In-terminal Messaging.

To supplement these efforts, it is recommended that BIS improve the in-terminal messaging for passengers and provide brief, clear instructions for recycling. Providing clear, instructional signage at the recycling stations or recycling bins can improve passenger participation and reduce contamination. See Section H below for information about signage.

Provide Ongoing Recycling Program Training.

It is recommended that BIS provide simple, on-going training for employees, tenants, and contractors that explains the recycling program, including its purpose and requirements. Such a training program will promote program participation and compliance, resulting in increased recycling and reduced contamination. In addition, training can designate a contact and a mechanism to receive feedback and ideas for improvement.

The format of employee training could take any number of forms, including emails, meetings, posters, etc. The content of such training should include:

- reminders about the materials that are accepted for recycling at the Airport and the location of the containers to be used for the program,
- information about purchasing requirements, and
- information about the positive effect the program is having on BIS's environmental impact.

It is recommended that the Airport include a brief overview of the recycling program during employee on-boarding training and recurrent refresher training at regular intervals. To use employee time as effectively as possible, waste training could be combined with other training or meetings.

BIS should also consider providing introductory level information to new tenants and provide training materials such as postings, postcards, etc. to existing tenants for use with their employees. As some airport tenants may experience significant employee turnover, providing this information on a regular basis (for example, annually) will help keep everyone up to date on the program.

Maintain and Update Recycling Education Program.

Once a training and education program is implemented, it is recommended that BIS actively maintain such a program to facilitate its continued success. The content of trainings should be updated as the program changes and grows.

Incorporate Information from Stakeholders in Education and Training Programs.

Information and participation from the waste collection contractor should also be incorporated into the training program. In addition, different stakeholders and organizations involved in collection, housekeeping, recycling, composting, and other waste activities could also be asked to provide content or to be present during training.

F. Containers and Bins

Collocate Garbage Cans and Recycling Stations and Maintain Consistent Placement and Configuration.

The existing recycling stations in the terminal are separate units with top or front facing signage, and restrictive lids; no changes to the design of the containers are recommended at this time. Top facing signage and restrictive lids have been shown to educate and instruct passengers to separate materials appropriately. It is highly recommended that BIS move a garbage can next to any recycling station or container that does not currently have one paired with it (as space and resources allow). Collocation of recycling containers with garbage cans has been shown to decrease contamination and increase recycling participation.

The recycling containers in other areas at the Airport vary in color, size, and design. Ideally, recycling stations should be consistent in design, color, and signage, throughout airport facilities. However, no major changes are recommended to the design of these bins at this time other than to ensure they and their service schedule are rightsized for the existing and future volume of material collected under the program and future improvements.

Remove Stand-Alone Trash Cans in the Terminal and Install Additional Recycling Bins

In addition, BIS should consider removing some of the stand-alone garbage cans inside the public areas of the terminal. There are many garbage cans in the terminal, and they are typically closer/more available than a recycling station; therefore, in many cases, it is more convenient for passengers, employees, and tenants to locate and use a garbage can for all materials than to find and use a recycling station.

These containers could be repurposed as recycling containers in other spaces for comingled or single stream recyclables (in offices for paper, in breakrooms for bottles and cans, etc.). It is recommended that BIS install additional recycling bins in other areas as the other areas are added to the program and resources allow.

Incorporate Maintenance Staff Input.

Airport maintenance staff conduct the day to day waste activities, their insight is valuable in improving and maintaining the recycling program at BIS. Their insight on which containers are underused or undersized can help inform changes to the location and size of existing and future recycling stations, recycling containers, and garbage cans.

G. Signage and Labeling

Expand and Improve Recycling Signage and Labeling.

The Airport's recycling signage could be expanded and improved. The recycling stations in the terminal are labeled for each accepted material but BIS should consider providing additional signage adjacent to recycling stations that elaborates on the Airport's program and provides direction for passengers. There are a variety of free, printable signage options, such as the one posted in the conference room, which are provided on the Waste Management website. These printable fliers can be laminated and posted at each recycling station to provide instructions and information.

A key location for additional signage is in the security checkpoint queuing area in the terminal. As described in Section 3, the TSA restrictions compel the generation of waste, and items discovered in passenger luggage must be disposed in accordance with the agency's policies. In addition, restricted items discovered in passenger luggage by TSA can prompt additional security screening that increases congestion and wait times in the security line. Clear signage in this area would help educate passengers on the restrictions as well as their options to comply with the restrictions to reduce wait times and without throwing these items away. Signage pertaining to the emptying of liquids and refill of containers post-security is discussed above.

Signage and labeling for recycling bins in other areas of the Airport is inconsistent or absent and could be improved with color, images, and short, clear, instructive text to improve understanding of which items are recyclable and which should be thrown away.

H. Other Recommendations

In addition to the strategies recommended above, the following strategies are recommended for BIS's waste and recycling program.

Contracts and Leases

Revise Contracts and Leases to Include Waste Management Preferences.

As described in Section 4, contracts are a vehicle through which the Airport can influence tenant behavior, including recycling. As contracts and leases expire, extend, or renew, it is advisable that the Airport consider revising the new contract language to include waste management requirements or preferences, for example, support of the recycling program. This could be a general clause stating a preference that tenants reduce, reuse, and recycle where practicable or specific information about recycling, reuse, or waste reduction objectives and requirements.

The contracts and leases could be improved by formalizing which, if any, of the Airport's bins, or dumpsters are available for tenant use, as it is unclear which tenants are currently using this infrastructure. If the Airport is open to managing waste and recyclables on behalf of its tenants (for a fee in lease rates), contracts and leases are the proper vehicle to clearly document this intent. Centralizing housekeeping, waste management, and recycling at BIS through contracts and leases may increase tenant participation in and conformance with the program.

Purchasing Policies and Requirements

Adopt a Purchasing Policy that Supports Waste Management Priorities.

The Airport's existing purchases may create waste; specific purchase information was not available for this project. It is recommended that the Airport (or City) consider adopting a purchasing policy that prioritizes items that are durable (versus disposable), reusable, recyclable, compostable, and/or made from recycled content. Once established, this policy could be shared with the Airport's tenants to encourage their own adoption of sustainability-minded purchasing practices.

Additional Facilities and New Development

Expand the Recycling Program to Areas Outside Airport Control.

The Airport may wish to consider expanding the recycling program to additional areas, for example, in the buildings and activities that were excluded from this plan. Expanding recycling and waste reduction to areas outside the Airport's control or influence will require cooperation and collaboration with the operators of those areas as well as with their housekeeping and waste hauling contractors. Expansion could be as simple as encouraging these areas to recycle and acting as a resource for their questions or as complex as assisting these areas with an evaluation of their facility and/or container selection and signage design.

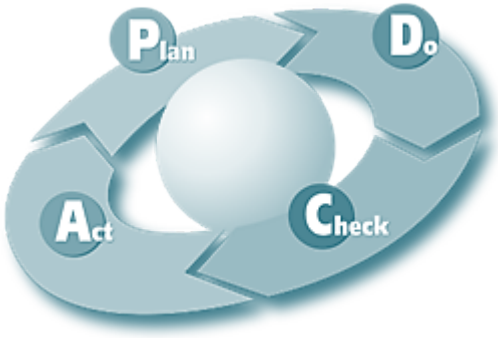
Incorporate Recycling and Waste Management Considerations into Future Development Projects.

As the Airport grows and changes, it is recommended that recycling and waste management be considered as a part of designing and constructing new development projects. This could be accomplished by establishing construction specifications that outline waste management requirements or preferences for Airport projects (for example, any landfill diversion rate requirements or recycled-content material preferences) and involving the waste collection contractor in the design and planning of new facilities. The operation and maintenance of new facilities under the control or influence of BIS, once constructed, should be included in the Airport's recycling program (for example a new general aviation hangar development).

Any expansions of the existing program should be designed with care to maintain consistency and compatibility with the program in the terminal, administration offices, and other established areas.

I. Continuous Improvement

Maintain and Improve the Program Through the Plan Do Check Act cycle.



It is recommended that BIS maintains and implements improvements to the recycling program by following the Plan Do Check Act cycle.

Plan

The recommended strategies and supporting references make up the "plan" portion of the process. Defining success (for example, something like 40 percent recycling by 2025), establishing materials and areas of focus, collecting baseline information (waste audit, surveys, etc.), identifying sub-goals, and identifying strategies are all part of planning. In the future, additional areas of focus, baseline measurements, and goals will likely be needed.

Do

Implementation of strategies included in this plan represents the "do" portion of the process. This involves implementing the recommendations in this plan and making progress toward achieving the goals. In "doing," the Airport will continue developing a culture of awareness for waste management and will begin to shape the practices and processes for improving and optimizing its activities associated with reduction, reuse, recycling, composting, and other waste management elements at the facility.

Check

As strategies are implemented, the "check" portion of the process involves reporting that requires regularly tracking and checking the progress toward meeting the goals. The Airport has finite resources (financial, staffing, capital, etc.), therefore, the management and tracking of the plan must not be unnecessarily arduous. If tracking and checking become too difficult or time consuming, the entire plan may suffer. Checking may require the Airport to develop and use tools for measuring success and identifying areas for improvement, including a mechanism for feedback and process for reviewing suggestions.

The following scenarios may trigger re-evaluation of the program and/or the constraints described in this document:

- New state recycling laws, requirements, or goals
- New BIS programs or goals
- New City of Bismarck programs or goals
- New Burleigh County programs or goals
- New local infrastructure, for example, composting facility
- Changes within or expiration of franchise agreement with waste hauling contractor(s)

Act

The "act" portion of the process encompasses taking what has been learned in the previous stages and actively responding. It can be helpful to ask, "What did we learn?" and "How can we do better next time?" By re-evaluating the strategies, activities, goals, and metrics, adjustments can be identified and put into action.

It is recommended that meetings on waste and recycling be held on a regular basis to drive the continuous improvement cycle (review the recycling program and plan and implement improvements/adjustments). It is further recommended that these meetings include a representative from each of the following areas: the waste hauling company, the airlines serving BIS, the restaurant tenant, other terminal tenants, a hangar tenant, the Bismarck community, and the traveling public.

J. Recommendations Summary

The recommendations outlined in this document do not require major capital improvements and were designed to be compatible with BIS's in-progress master plan, the existing recycling program, and other airport requirements.

Table 4 summarizes recommendations for the BIS waste and recycling program.

Table 4 - BIS Waste and Recycling Program Recommendations Summary

BIS Waste and Recycling Program Recommendations
OBJECTIVES AND TARGETS
- Set SMART goals (see Section 7).
TRACKING AND REPORTING
- Estimate and track key metrics: volume of waste to landfill, volume of material collected for recycling, recycling rate, and costs for waste and recycling services.
- Assess trends for issues or opportunities for improvement (For example, waste generation, landfill, recycling, and cost trends.)
- Establish a regular reporting schedule; proactively provide information about the program.
REDUCE AND REUSE
- Substitute disposable items with durable alternatives; reuse items and materials.
- Promote and facilitate emptying of water bottles in restroom sinks and refilling post security. o Post water bottle emptying/refilling signs to encourage reuse of disposable water bottles. o Post recycling of disposable water bottles that are not refilled. o Place a recycling station in immediate proximity of the pre-security restrooms. o Install liquid collections station at security checkpoint, if liquids are on-going issue in this location.
- Work with the restaurant tenant to donate edible food.
- Collect and donate unopened food, beverage, and toiletry items.
- Provide Supplies, Fixtures, and Project Guidelines Which Encourage Reuse. o Issue reusable tumblers, water bottles, or mugs to staff. o Provide water bottle refill stations. o Provide location for passengers to discard and reuse magazines and newspapers. o Specify reuse considerations in construction projects.
RECYCLE AND COMPOST
Paper
- Continue the paper recycling program; ask about adding non-shredded office paper, newspapers, and magazines to the shredded paper collection.
- Expand paper recycling program to additional areas, specifically airline deplaned newspapers and magazines and expired items from the newsstand.

Plastic Bottles and Aluminum Cans, Plastic Cups
- Continue and expand the plastic bottle and aluminum can recycling program to additional areas, specifically airline deplaned beverage containers.
- Coordinate plastic cup recycling with the airlines serving BIS.
Cardboard
- Continue the cardboard recycling program;
- Provide feedback to tenants on the progress and performance of this program, solicit their feedback, and market the program to all tenants.
- Approach Waste Management to evaluate potential to increase the value of cardboard by separating it from other streams.
Glass
- Continue the glass recycling program; approach Waste Management to determine whether it is possible to collect and manage glass separately to reduce contamination in this material stream.
- Provide feedback to tenants on the progress and performance of this program and solicit their feedback.
Other Recyclables
- Work with the waste hauling contractor to design and implement strategies for other materials as they are identified in the waste stream.
Green Waste
- Evaluate how this material is managed and explore opportunities to implement strategies in alignment with the EPA hierarchy (reduction, reuse, compost, and lastly disposal).
Food Waste
- Implement food waste composting at BIS if a composting facility is established in the area,.   o Start with coffee grounds, then expand to other pre-consumer food waste.
Paper Products
- Implement paper product composting at BIS when a composting facility is established in the area,.
Energy from Waste (EfW)
- Utilize the EfW facility for all waste materials that cannot be reused, donated, recycled, or composted and track this stream, if an EfW facility is established in the area.
EDUCATION AND OUTREACH
- Improve in-terminal messaging for passengers.   o Provide clear, instructional signage at recycling stations.
- Provide simple, on-going training for employees, tenants, and contractors.
- Maintain and update educational program.
- Incorporate stakeholder information in education and training.
CONTAINERS AND BINS
- Collocate recycling bins and garbage cans; maintain consistent placement and configuration
- Remove standalone trash cans.

- Install additional recycling stations (specifically in high traffic areas of the terminal).
- Install additional recycling bins and garbage cans in other areas, as they are added to program.
- Incorporate feedback from Airport maintenance staff to maintain and improve recycling program at BIS.
SIGNAGE AND LABELING
- Expand and improve signage to elaborate on the program and provide direction, specifically, in the checkpoint queuing area.
OTHER RECOMMENDATIONS
Contracts and Leases
- Revise new contract and lease language to include waste management requirements/preferences.
Purchasing Policies and Requirements
- Adopt a purchasing policy that prioritizes materials that are durable, reusable, recyclable, compostable, and/or made from recycled content.   o Share with tenants to encourage them to adopt their own similar practices.
Additional Facilities and New Development
- Expand program to areas outside Airport control (through collaboration with operators of areas excluded from this plan).
- Incorporate recycling and waste management considerations as part of designing and constructing new development.
Continuous Improvement
- Maintain and improve the recycling and waste program according to Plan Do Check Act cycle.

8. Conclusion

BIS currently has a simple recycling program in place that includes basic elements and has the potential to be expanded in phases to further reduce the facility's environmental impact. This document has described the existing program and outlined recommended improvements that will allow BIS to potentially increase both landfill diversion and recycling volumes. In addition, this plan documents and supports BIS's compliance with the FMRA of 2012 and FAA guidance for recycling, reuse, and waste reduction.

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CITY OF BISMARCK

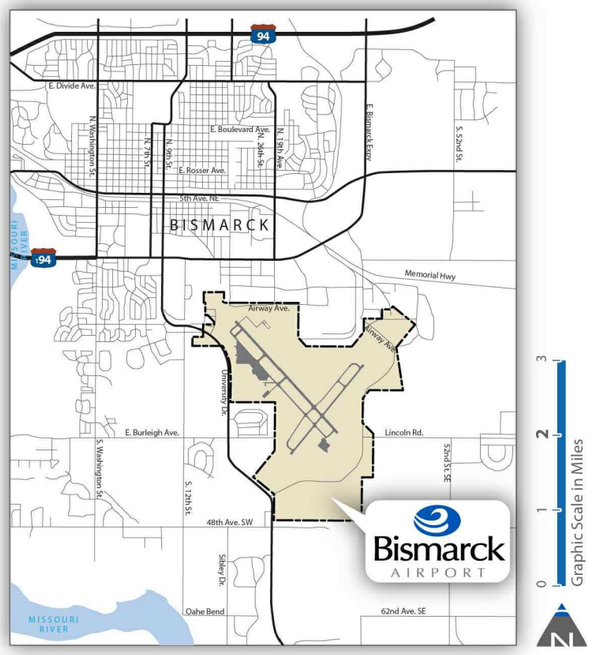
BISMARCK AIRPORT LAYOUT PLAN

2301 UNIVERSITY DR., BISMARCK, ND 58504

AIP# 3-38-003-055-2015

JAN 2019

VICINITY MAP



LOCATION MAP

FAA APPROVAL

SPONSOR APPROVAL	
NAME/TITLE	DATE

NDAC APPROVAL	
NAME/TITLE	DATE

REVISIONS & NOTES		
NO.	DESCRIPTION	DATE
NOTES:		

SHEET INDEX	
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2	AIRPORT DATA
3	AIRPORT LAYOUT PLAN
4	AIRPORT AIRSPACE - CONICAL SURFACE
5	AIRPORT AIRSPACE - EXTENDED NORTH PLAN
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9	RUNWAY 13 INNER APPROACH PLAN & PROFILE
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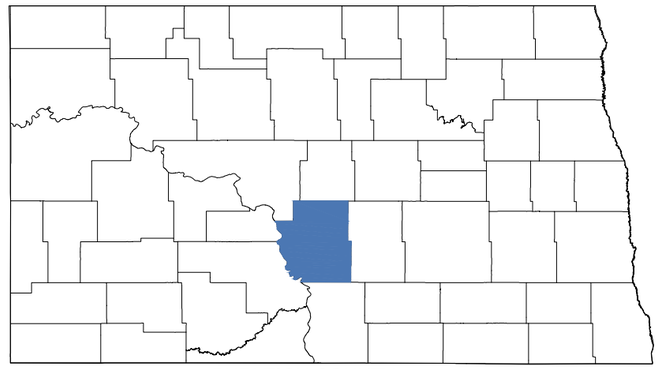

BURLEIGH COUNTY

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Bismarck AIRPORT

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CITY OF BISMARCK
BISMARCK AIRPORT LAYOUT PLAN

2301 University Dr., Bismarck, ND 58504

ISSUED

NOT FOR CONSTRUCTION

M&H PROJECT:	2716000-140293.01
AIP NO.:	3-38-003-055-2015
DATE:	JAN 2019
DESIGNED BY:	MRB
DRAWN BY:	JWB
CHECKED BY:	MRB

DO NOT SCALE DRAWINGS

SHEET CONTENTS

TITLE SHEET

SHEET NO.

1

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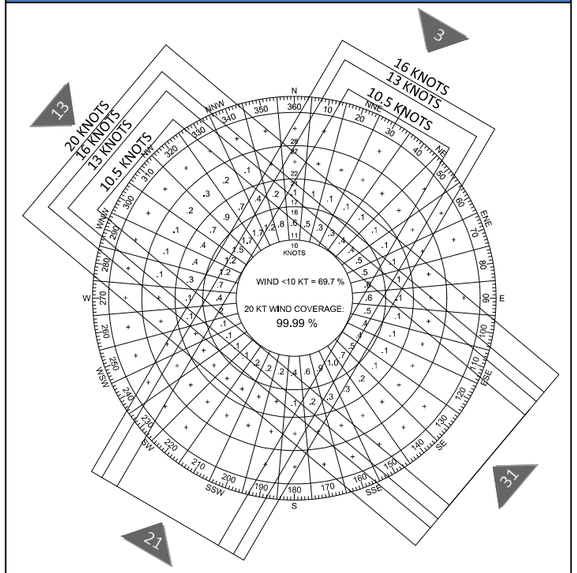
ALL WEATHER WINDROSE

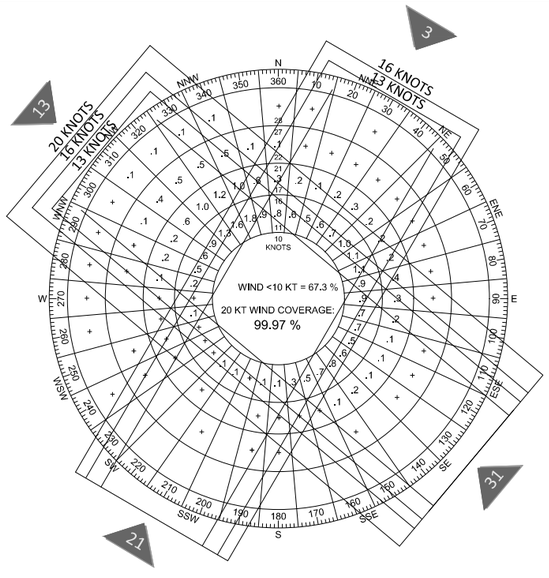


ALL WEATHER WIND COVERAGE

	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	79.48%	86.88%	94.15%	98.16%
Runway 13-31	92.85%	96.47%	99.00%	99.78%
Runways Combined	97.86%	99.42%	99.89%	99.99%

SOURCE: NOAA National Climatic Center Asheville, N.C.
DATA STATION: Bismarck Airport Bismarck, North Dakota
OBSERVATIONS: 107,173 Observations 2005 - 2015

IFR WEATHER WINDROSE



IFR CAT-I WIND COVERAGE

	10.5 Knots	13 Knots	16 Knots	20 Knots
Runway 3-21	79.50%	86.46%	93.22%	97.47%
Runway 13-31	89.04%	93.92%	97.91%	99.50%
Runways Combined	96.57%	98.93%	99.84%	99.97%

SOURCE: NOAA National Climatic Center Asheville, N.C.
DATA STATION: Bismarck Airport, Bismarck, North Dakota
OBSERVATIONS: 6,527 Observations 2005 - 2015

RUNWAY DATA

	RUNWAY 13/31				RUNWAY 3/21			
	EXISTING		FUTURE		EXISTING		FUTURE	
	13	31	13	31	3	21	3	21
RUNWAY DESIGN CODE (RDC)	D-III	D-III	SAME	SAME	C-II	C-II	SAME	SAME
APPROACH REFERENCE CODE (APRC)	D-III-4000	D-III-2400	SAME	SAME	C-II-4000	C-II-4000	SAME	SAME
DEPARTURE REFERENCE CODE (DPRC)	D-III	D-III	SAME	SAME	C-II	C-II	SAME	SAME
RUNWAY PAVEMENT TYPE	ASPHALT		CONCRETE		ASPHALT		CONCRETE	
SURFACE TREATMENT	GROOVED		SAME		GROOVED		SAME	
PAVEMENT STRENGTH (IN 1000 LBS.)	130(S)/180(D)/340(DT)		TBD		NO DATA AVAILABLE		TBD	
PAVEMENT STRENGTH (PCN)	42		100		26		50	
EFFECTIVE RUNWAY GRADIENT %	0.09	0.09	SAME	SAME	0.22	0.22	SAME	SAME
ALL WEATHER WIND COVERAGE % (20 KNOTS)	99.78	99.78	SAME	SAME	98.16	98.16	SAME	SAME
RUNWAY WIDTH X LENGTH	150' x 8794'		SAME		100' X 6,600'		SAME	
RUNWAY SAFETY AREA WIDTH X LENGTH OFF ENDS	500' X 1000'	500' X 1000'	SAME	SAME	500' X 1000'	500' X 1000'	SAME	SAME
RUNWAY END COORDINATES (NAD 83)	LAT.46° 47' 02.23"N LON.100° 45' 42.43"W	LAT.46° 45' 58.15"N LON.100° 44' 17.23"W	SAME SAME	SAME SAME	LAT.46° 45' 45.42"N LON.100° 44' 54.29"W	LAT.46° 46' 36.02"N LON.100° 43' 54.59"W	SAME SAME	SAME SAME
RUNWAY END ELEVATION	1654.3'	1644.9'	SAME	SAME	1660.4'	1661.1'	SAME	SAME
RUNWAY LIGHTING	HIRL		SAME		HIRL		SAME	
RUNWAY MARKING	PRECISION	PRECISION	SAME	SAME	PRECISION	PRECISION	SAME	SAME
RUNWAY PROTECTION ZONE DIMENSIONS	1000'X1510'X1700'	1000'X1750'X2500'	1000'X1750'X2500'	SAME	500'X1010'X1700'	500'X1010'X1700'	SAME	SAME
FAR PART 77 APPROACH CATEGORY	50:1	50:1	SAME	SAME	34:1	34:1	SAME	SAME
APPROACH TYPE	PRECISION	PRECISION	SAME	SAME	NON-PREC	NON-PREC	SAME	SAME
APPROACH VISIBILITY MINIMUMS	3/4-MILE	1/2-MILE	1/2-MILE	SAME	3/4-MILE	3/4-MILE	SAME	SAME
AERONAUTICAL SURVEY REQUIRED	VERTICALLY GUIDED	VERTICALLY GUIDED	SAME	SAME	VERTICALLY GUIDED	VERTICALLY GUIDED	SAME	SAME
RUNWAY DESIGNATION	NON-UTILITY		SAME		NON-UTILITY		SAME	
RUNWAY DEPARTURE SURFACE	YES	YES	SAME	SAME	YES	YES	SAME	SAME
RUNWAY SHOULDER WIDTH	NONE		SAME		NONE		SAME	
RUNWAY OBJECT FREE AREA WIDTH X LENGTH OFF ENDS	800' X 1000'	800' X 1000'	SAME	SAME	800' X 1000'	800' X 1000'	SAME	SAME
RUNWAY OBSTACLE FREE ZONE WIDTH	400'		SAME		400'		SAME	
RUNWAY OBSTACLE FREE ZONE CRITERIA	CRITERIA MET		SAME		CRITERIA MET		SAME	
THRESHOLD SITING SURFACE (TSS) EB99	TYPE 5, 6, 7	TYPE 5, 6, 7	SAME	SAME	TYPE 4, 6, 7	TYPE 4, 6, 7	SAME	SAME
VISUAL APPROACH AIDS - FAA OWNED	MALS, PAPI	MALSR	SAME + MALSR	SAME	NONE	NONE	SAME	SAME
VISUAL APPROACH AIDS - SPONSOR OWNED	LIGHTED WINDCONE BEACON	LIGHTED WINDCONE, PAPI	SAME	SAME	LIGHTED WINDCONE, REILS, PAPI	LIGHTED WINDCONE, REILS, PAPI	SAME	SAME
INSTRUMENT APPROACH AIDS - FAA	LOC,GS,ILS,GPS	LOC,GS,ILS,GPS	SAME	SAME	RNAV (GPS)		SAME	
INSTRUMENT APPROACH AIDS - SPONSOR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RUNWAY TOUCHDOWN ZONE ELEVATION (NAVD88)	1,653.3	1,647.2'	SAME	SAME	1659.3'	1,660.0	SAME	SAME
DESIGN AIRCRAFT BY RUNWAY	A-320/MD-80		SAME		FALCON 50		SAME	
WINGSPAN (FEET)	112/108		SAME		62		SAME	
UNDERCARRIAGE (FEET)	50/30 71/21		SAME		24/15		SAME	
APPROACH SPEED (KTS)	136/144		SAME		132		SAME	
DECLARED DISTANCES TORA	8,794'	8,794'	SAME	SAME	6,600'	6,600'	SAME	SAME
TODA	8,794'	8,794'	SAME	SAME	6,600'	6,600'	SAME	SAME
ASDA	8,794'	8,794'	SAME	SAME	6,600'	6,600'	SAME	SAME
LDA	8,794'	8,794'	SAME	SAME	6,600'	6,600'	SAME	SAME
RUNWAY LINE-OF-SIGHT	CRITERIA MET		SAME		CRITERIA MET		SAME	
VERTICAL & HORIZONTAL DATUM	NAVD88 & NAD83		SAME		NAVD88 & NAD83		SAME	
NOTE: N/A = NOT APPLICABLE, TBD = TO BE DETERMINED								

AIRPORT DATA

	EXISTING	FUTURE
AIRPORT REFERENCE CODE (ARC)	D-III	SAME
MEAN MAX. TEMPERATURE (HOTTEST MONTH)	84.4 (JULY)	SAME
AIRPORT ELEVATION (AMSL) (NAVD88)	1661.1'	SAME
AIRPORT NAVAIDS	GPS/ILS/PAPI RNAV/BEACON	SAME SAME
AIRPORT REFERENCE POINT (ARP) (NAD83)	LAT. N 46°46'21.8" LON. W 100°44'44.7"	SAME SAME
CRITICAL AIRCRAFT	A-320/MD-80	SAME
WINGSPAN (FEET)	112/108	SAME
UNDERCARRIAGE (FEET)	50/30 71/21	SAME
APPROACH SPEED (KTS)	136/144	SAME
TAIL HEIGHT (FEET)	40/31	SAME
AIRPORT MAGNETIC VARIATION (AUG. 2018)	6° 0' E	0° 6' W/ yr.
NPIAS SERVICE LEVEL	CS	SAME
STATE EQUIVALENT SERVICE ROLE	COMMERCIAL SERVICE	SAME
AIRPORT PROERTY (ACRES)	2,143	SAME
MISCELLANEOUS FACILITIES	ASR, RTR, RVR, ASOS	SAME

TAXIWAY DATA

		T/W 'C,C1,C3,D*'		T/W 'D*,D1,D2,D3,C2,C4'		T/W 'B,B1'	
		EXISTING	FUTURE	EXISTING	FUTURE	EXISTING	FUTURE
TAXIWAY DESIGN GROUP (TDG)		5	SAME	4	SAME	2	SAME
WIDTH IN FEET (STANDARD)		75'/100'/90'/60' (75')	SAME	60'/100'/95'/95'/130'/60' (50')	SAME	35'/35' (35')	SAME
SAFETY AREA WIDTH		171'	SAME	118'	SAME	79'	SAME
OBJECT FREE AREA WIDTH		259'	SAME	186'	SAME	131'	SAME
SEPARATION (IN FEET)	T/W TO T/W	215'	SAME	152'	SAME	105'	SAME
	T/W TO OBJECT	129.5'	SAME	93'	SAME	65.5'	SAME
LIGHTING TYPE		MITL	SAME	MITL	SAME	MITL	SAME
DESIGN AIRCRAFT		B-757	SAME	MD-80	SAME	BE-200	SAME

NOTE:
TAXIWAY DESIGN CRITICAL AIRCRAFT MAY DIFFER FROM AIRPORT DESIGN CRITICAL AIRCRAFT.
* TAXIWAY D IS TDG 5 BETWEEN C & 13/31, TDG 4 FOR REMAINDER.

MODIFICATION TO STANDARDS

ITEM	AIRPLANE DESIGN GROUP EXISTING	AIRPLANE DESIGN GROUP FUTURE	STANDARD EXISTING	STANDARD FUTURE	MODIFICATION EXISTING	MODIFICATION FUTURE	REMARKS	APPROVED
NONE REQUIRED								

SPONSOR APPROVAL

NAME/TITLE DATE

REVISIONS & NOTES

NO.	DESCRIPTION	DATE

NOTES:

Mead & Hunt

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424 S 3rd Street, Suite 107
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Bismarck AIRPORT

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CITY OF BISMARCK
BISMARCK AIRPORT LAYOUT PLAN

2301 UNIVERSITY DR., BISMARCK, ND 58504

ISSUED

NOT FOR CONSTRUCTION

M&H PROJECT: 2716000-140293.01
AIP NO.: 3-38-003-055-2015
DATE: JAN 2019
DESIGNED BY: MRB
DRAWN BY: JWB
CHECKED BY: MRB
DO NOT SCALE DRAWINGS

SHEET CONTENTS
AIRPORT DATA

SHEET NO. 2 of 22

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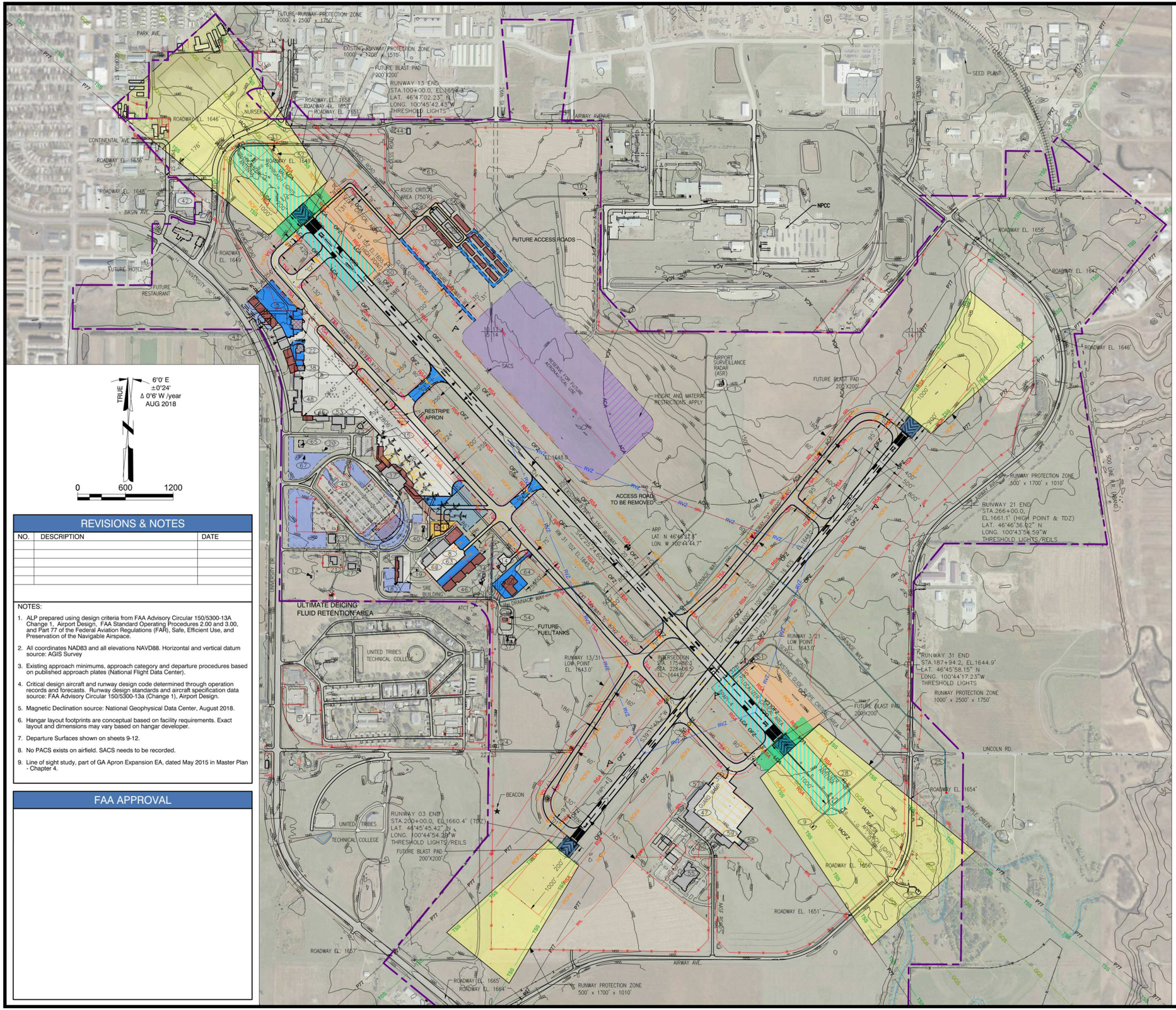

REVISIONS & NOTES

NO.	DESCRIPTION	DATE

NOTES:

1. ALP prepared using design criteria from FAA Advisory Circular 150/5300-13A Change 1, Airport Design, FAA Standard Operating Procedures 2.00 and 3.00, and Part 77 of the Federal Aviation Regulations (FAR), Safe, Efficient Use, and Preservation of the Navigable Airspace.
2. All coordinates NAD83 and all elevations NAVD88. Horizontal and vertical datum source: AGIS Survey
3. Existing approach minimums, approach category and departure procedures based on published approach plates (National Flight Data Center).
4. Critical design aircraft and runway design code determined through operation records and forecasts. Runway design standards and aircraft specification data source: FAA Advisory Circular 150/5300-13a (Change 1), Airport Design.
5. Magnetic Declination source: National Geophysical Data Center, August 2018.
6. Hangar layout footprints are conceptual based on facility requirements. Exact layout and dimensions may vary based on hangar developer.
7. Departure Surfaces shown on sheets 9-12.
8. No PACS exists on airfield. SACS needs to be recorded.
9. Line of sight study, part of GA Apron Expansion EA, dated May 2015 in Master Plan - Chapter 4.

FAA APPROVAL

BUILDING LEGEND

EXT	ULT	DESCRIPTION	TOP ELEV.
1*	1	FAA APPROACH SURVEILLANCE RADAR	1719.5'
2		OPS BLDG/EMERGENCY GENERATOR	1665.2'
4		BISMARCK AERO CENTER HANGAR	1671.5'
5*		CITY HANGAR (TO BE REMOVED)	1690.9'
6		EXECUTIVE AIR TAXI	1696.5'
7		BISMARCK AERO CENTER HANGAR	1671.5'
8		CORP. HANGAR/OFFICE	1679.8'
9		MALSR BUILDING / ENGINE GENERATOR	1660.0'
10		FAA REMOTE TRANSMITTER/RECEIVER (RTR)/RCAG ANTENNA TOWER	1726.3'
12		NWS INFLATION SHELTER	1690.2'
13*		U.S. WEST TELEPHONE BUILDING	
14		AIRPORT FIRE DEPARTMENT (ARFF)	1685.6'
15*		VAULT, COOLING TOWER, EMERGENCY GENERATOR	1665.8'
16*		GARAGE	
17		AIRLINE TERMINAL/AIRPORT ADMIN BUILDING	1717.0'
18		AIRPORT MAINTENANCE BUILDING	1675.7'
19		LIFT STATION #2	1658.8'
20		LIFT STATION #1	1660.4'
21		EMER. MANAGEMENT & COMBINED COMM. CENTER	1670.3'
22*		FBO/NDAC (TO BE RELOCATED)	1669.6'
23		FAA DAK-MINN ADO OFFICE	1693.9'
24		ELECTRICAL VAULT - RWY. 3/21	1671.9'
25		STORAGE GARAGE	
26		LIFT STATION #3	
27		NATIONAL WEATHER SERVICE	1676.6'
28		FAA LOCALIZER - RWY. 13	1660.3'
29		AEROSTOR CONDO #1	1677.8'
30		AREA 51 HANGAR ASSOCIATION	
	31	T-HANGAR SITE C	
	32	T-HANGAR SITE D	
33		FAA LOCALIZER - RWY. 31	1662.9'
34		FAA ATCT GARAGE & EMERGENCY GENERATOR	1660.9'
35		FAA MIDDLE MARKER - RWY. 31	
37		BISMARCK AIRPORT FUEL TANK FARM	1673.0'
38*		WAY-POINT AVIONICS (TO BE REMOVED)	1677.2'
40		FAA REMOTE TRANSMITTER BUILDING/RCAG	1657.5'
41*		CITY HANGAR (TO BE REMOVED)	1671.7'
42		GAS STATION	1670.9'
43*		MEISNER OFFICE BUILDING (TO BE REMOVED)	1664.9'
44		STORAGE BUILDING	1691.7'
45		BIS AERO CENTER	1674.7'
46		FAA AIR TRAFFIC CONTROL TOWER	1733.4'
47		ND NATIONAL GUARD A.A.S.F.	1697.7'
48		EXECUTIVE AIR TAXI	1676.3'
49		EXISTING PAY PARKING LOT EXIT PLAZA	1672.6'
50		FAA GLIDE SLOPE - RWY. 13/ASOS	1700.7'
51		FAA GLIDE SLOPE - RWY. 31	1670.6'
52		FAA MALS - RWY. 13	1659.3'
53		BISMARCK AERO CENTER	1673.5'
54		EXECUTIVE AIR FUEL FARM	1658.5'
55		ND NATIONAL GUARD A.A.S.F. READINESS CENTER	1684.2'
56		BEYER HANGAR	1684.3'
57		ND NG AASF FUEL TRUCK CONTAINMENT AREA	1697.7'
58		ND NATIONAL GUARD A.A.S.F. AIRCRAFT WASH RACK	1690.3'
59		ND NATIONAL GUARD A.A.S.F.	1687.6'
	60	SNOW REMOVAL EQUIPMENT (SRE) BUILDING	
	61	T-HANGARS	
	62	GENERAL AVIATION AREA	
	63	CORPORATE AVIATION AREA	
	64	ELECTRICAL VAULT AREA	
	65	CAR WASH FACILITIY	
	67	RENTAL CAR STORAGE LOT	
68		CORP. HANGAR/OFFICE	

* TO BE REMOVED CR RELOCATED

DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT CONTROLLED PROPERTY LINE (FEE & EASEMENTS)		
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
PART 77 APPROACH SURFACE	P77	
THRESHOLD SITING SURFACE	TSS	
GQS SURFACE	GQS	
RUNWAY VISIBILITY ZONE	RVZ	
BUILDING RESTRICTION LINE	BRL	
OBSTACLE FREE ZONE	OFZ	
RUNWAY SAFETY AREA	RSA	
RUNWAY OBJECT FREE AREA	ROFA	
GLIDE SLOPE CRITICAL AREA (GCA)	GCA	
LOCALIZER CRICITAL AREA (LCA)	LCA	
AIRPORT SURVEILLANCE RADAR CRICITAL AREA (ACA)	ACA	
AIRPORT SECURITY FENCE 8'-10' (VARIES BY LOCATION)		
PRECISION OBSTACLE FREE ZONES (POFZ)		
GLIDE SLOPE CRITICAL AREA	GCA	
LOCALIZER CRITICAL AREA	LCA	
FUEL STORAGE AREA		
AIRPORT BEACON		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
VISUAL APPROACH SLOPE INDICATOR (VASI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		
AIRPORT REFERENCE POINT (ARP)		
FUTURE DEVELOPMENT AREA		
SACS		

Mead & Hunt

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Bismarck AIRPORT

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CITY OF BISMARCK
BISMARCK AIRPORT LAYOUT PLAN

2301 UNIVERSITY DR., BISMARCK, ND 58504

ISSUED

NOT FOR CONSTRUCTION

M&H PROJECT: 2716000-140293.01
AIP NO.: 3-38-003-055-2015
DATE: JAN 2019
DESIGNED BY: M&H
DRAWN BY: JWB
CHECKED BY: MRB
DO NOT SCALE DRAWINGS

SHEET CONTENTS
AIRPORT LAYOUT PLAN

SHEET NO. 3 of 22

3

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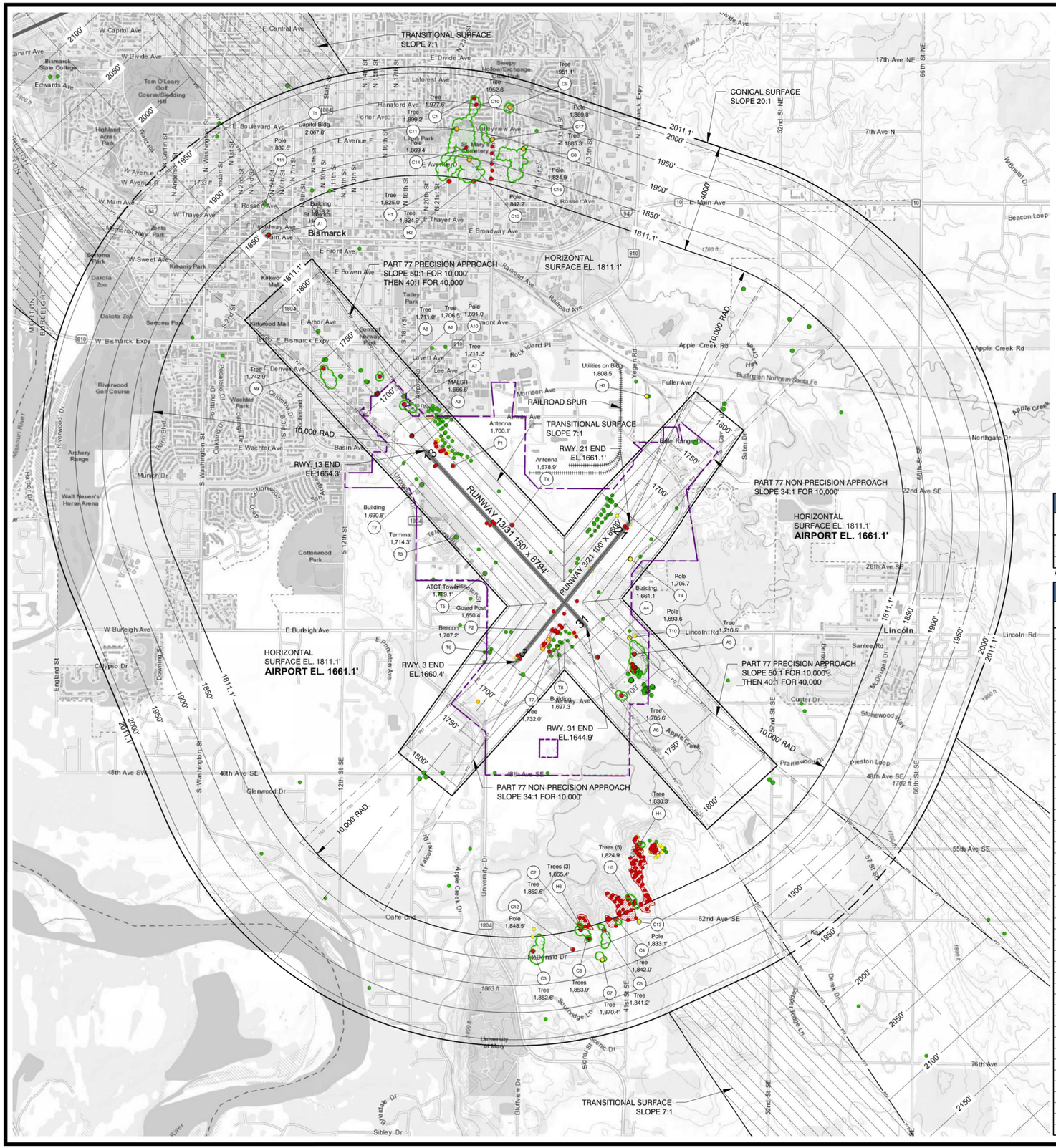
TRANSITIONAL SURFACE
SLOPE 7:1
CONICAL SURFACE
SLOPE 20:1
PART 77 PRECISION APPROACH
SLOPE 50:1 FOR 10,000'
THEN 40:1 FOR 40,000'
HORIZONTAL
SURFACE EL. 1811.1'
PART 77 NON-PRECISION APPROACH
SLOPE 34:1 FOR 10,000'
HORIZONTAL
SURFACE EL. 1811.1'
AIRPORT EL. 1661.1'
RUNWAY 13/31 150' x 8794'
RUNWAY 3/21 100' X 6000'
RWY. 13 END
EL. 1654.3'
RWY. 21 END
EL. 1661.1'
RWY. 3 END
EL. 1660.4'
RWY. 31 END
EL. 1644.9'
10,000' RAD.
RAILROAD SPUR
Bismarck
Lincoln
W Capitol Ave
E Central Ave
W Divide Ave
E Divide Ave
E Boulevard Ave
E Avenue F
W Avenue A
W Avenue B
W Main Ave
E Main Ave
W Thayer Ave
E Thayer Ave
E Broadway Ave
E Rosser Ave
W Rosser Ave
E Front Ave
W Sweet Ave
E Bowen Ave
E Arbor Ave
W Bismarck Expy
E Bismarck Expy
E Denver Ave
E Wachter Ave
Basin Ave
Apple Creek Rd
Fuller Ave
Lee Ave
Levett Ave
Morrison Ave
Avenue A
Rock Island Pl
Railroad Ave
Northgate Dr
7th Ave N
17th Ave NE
22nd Ave SE
28th Ave SE
48th Ave SW
48th Ave SE
55th Ave SE
62nd Ave SE
76th Ave
Lincoln Rd
Santee Rd
Custer Dr
Stonewood Dr
Preston Loop
Prairiewood Dr
Glenwood Dr
Cottonwood Park
Riverwood Golf Course
Archery Range
Walt Neuen's Horse Arena
Dakota Zoo
Sertoma Park
Kirkwood Mall
Century Newman Park
Talley Park
Wachter Park
Lions Park
Highland Acres Park
Memorial Hwy Park
Zinda Park
Kohanny Park
Bismarck State College
Tom O'Leary Golf Course/Sledding Hill
St. Mary Cemetery
University of Mary
Missouri River
Apple Creek
Burlington Northern Santa Fe
Beacon Loop
Sibley Dr
Falcone Dr
Apple Creek Dr
Oahe Blvd
McDermid Dr
Southridge Ln
Derek Dr
Cedar Ridge Ln
Kari Dr
Bluffview Dr
Sunset Dr
Capitol Bldg
2,067.8'
ATCT Tower
1,729.1'
Guard Post
1,650.4'
Beacon
1,707.2'
Terminal
1,714.3'
Building
1,690.8'
MALSR
1,666.6'
Antenna
1,700.1'
Antenna
1,678.9'
Utilities on Bldg
1,808.5'
Building
1,661.1'
Building
1,697.3'
Tree
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Trees (5)
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Trees (3)
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Trees
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Tree
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Pole
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Pole
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Tree
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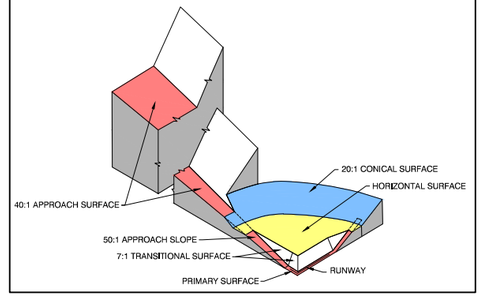
Tree
1,822

TYPICAL FAR PART 77 SURFACES



LEGEND: PLAN VIEW

- Existing Runway
- Airport Controlled Property Line (Fee&Easements)
- Part 77 Surfaces
- Part 77 Approach Surface
- Part 77 Surface Contour
- Threshold Siting Surface
- Terrain Contours
- Object Penetrates Part 77 Surface
- Object Within 10ft. Part 77 Surface
- Object Clear >20ft. Part 77 Surface
- Terrain Penetrations

TRUE
6°0' E
±0°24'
Δ 0°6' W /year
AUG 2018

0 2000 4000

REVISIONS & NOTES

NO.	DESCRIPTION	DATE

NOTES:

- Runway ends, Part 77 surface contours and obstruction elevations are shown in NAD83 and NAVD88. All elevations in feet above mean sea level (MSL).
- Object and runway end elevation source: AGIS Survey, Martinez Geospatial, November 2015.
- Basemap source: USGS Topographic maps.
- Only airspace surfaces associated with the existing runway and instrument approaches are illustrated (no changes proposed).
- See Inner-Approach Plan for close-in obstructions in RPZ areas and lateral transitional surfaces.
- See Departure Surfaces for 40:1 departure surfaces for each runway.
- For the Data Tables, a negative penetration value indicates the object is clear of the airspace surface.

PART 77 OBJECTS

POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	OBJECT AGL HEIGHT	PART 77 SURFACE	PART 77 SURFACE ELEVATION	PART 77 PENETRATION	20:1 TSS SURFACE ELEVATION	TSS PENETRATION	DISPOSITION
A1	McKenzie Building	1816.2	136.2'	Horizontal	1,811.1'	4.9'	1,935.8'	-119.6'	Obstruction Light
T1	Capitol Bldg	2067.8	264.8'	Transitional	2,342.6'	-274.8'	Object Not Under Surface		No Action
A11	Pole	1832.6	44.0'	Approach	1,862.4'	-29.8'	1,960.4'	-127.8'	No Action

Mead & Hunt

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2301 UNIVERSITY DR., BISMARCK, ND 58504

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AIP NO.:	3-38-003-055-2015
DATE:	JAN 2019
DESIGNED BY:	M&H
DRAWN BY:	JWB
CHECKED BY:	MRB

DO NOT SCALE DRAWINGS

SHEET CONTENTS

AIRPORT AIRSPACE - EXTENDED NORTH PLAN

SHEET NO.

5 of 22

5

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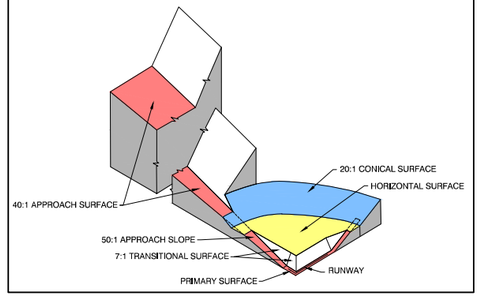
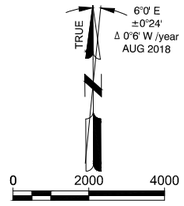
TYPICAL FAR PART 77 SURFACES



LEGEND: PLAN VIEW

- Existing Runway
- Airport Controlled Property Line (Fee&Easement)
- Part 77 Surfaces
- Part 77 Approach Surface
- Part 77 Surface Contour
- Threshold Siting Surface
- Terrain Contours
- Object Penetrates Part 77 Surface
- Object Within 10ft. Part 77 Surface
- Object Clear >20ft. Part 77 Surface
- Terrain Penetrations



REVISIONS & NOTES

NO.	DESCRIPTION	DATE

NOTES:

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- Basemap source: USGS Topographic maps.
- Only airspace surfaces associated with the existing runway and instrument approaches are illustrated (no changes proposed).
- See Inner-Approach Plan for close-in obstructions in RPZ areas and lateral transitional surfaces.
- See Departure Surfaces for 40:1 departure surfaces for each runway.
- For the Data Tables, a negative penetration value indicates the object is clear of the airspace surface.

Mead & Hunt

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2301 UNIVERSITY DR., BISMARCK, ND 58504

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M&H PROJECT:	2716000-140293.01
AIP NO.:	3-38-003-055-2015
DATE:	JAN 2019
DESIGNED BY:	M&H
DRAWN BY:	JWB
CHECKED BY:	MRB

DO NOT SCALE DRAWINGS

SHEET CONTENTS

AIRPORT AIRSPACE - EXTENDED SOUTH PLAN

SHEET NO. 6 of 22

6

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REVISIONS & NOTES

NO.	DESCRIPTION	DATE

NOTES:

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- Basemap source: USGS Topographic maps.
- Only airspace surfaces associated with the existing runway and instrument approaches are illustrated (no changes proposed).
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- See Departure Surfaces for 40:1 departure surfaces for each runway.
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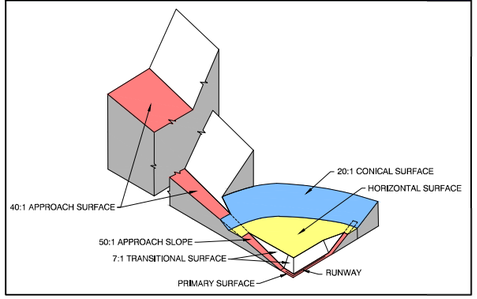
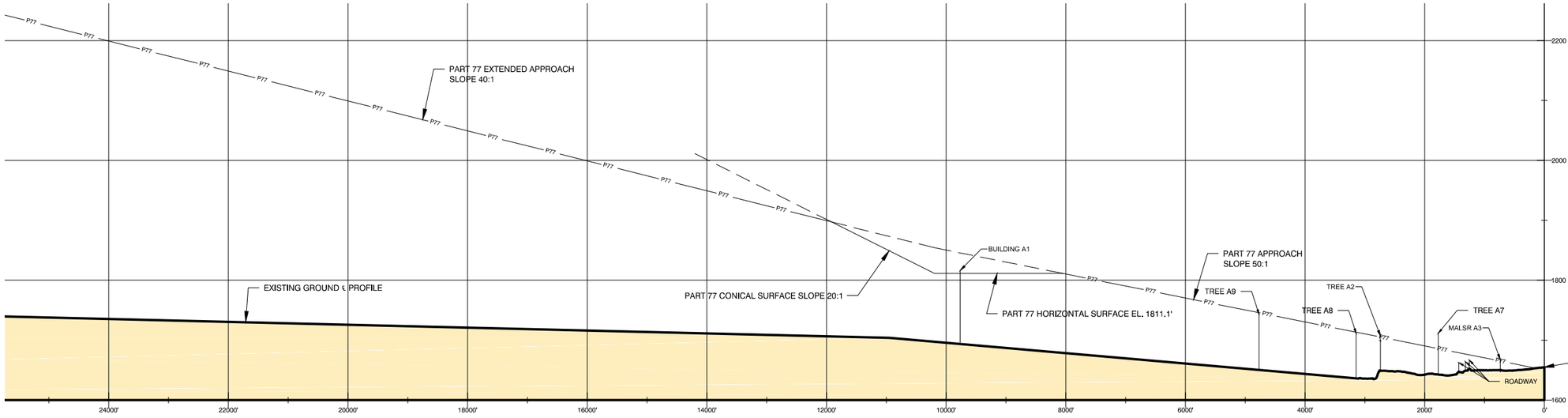
PART 77 OBJECTS

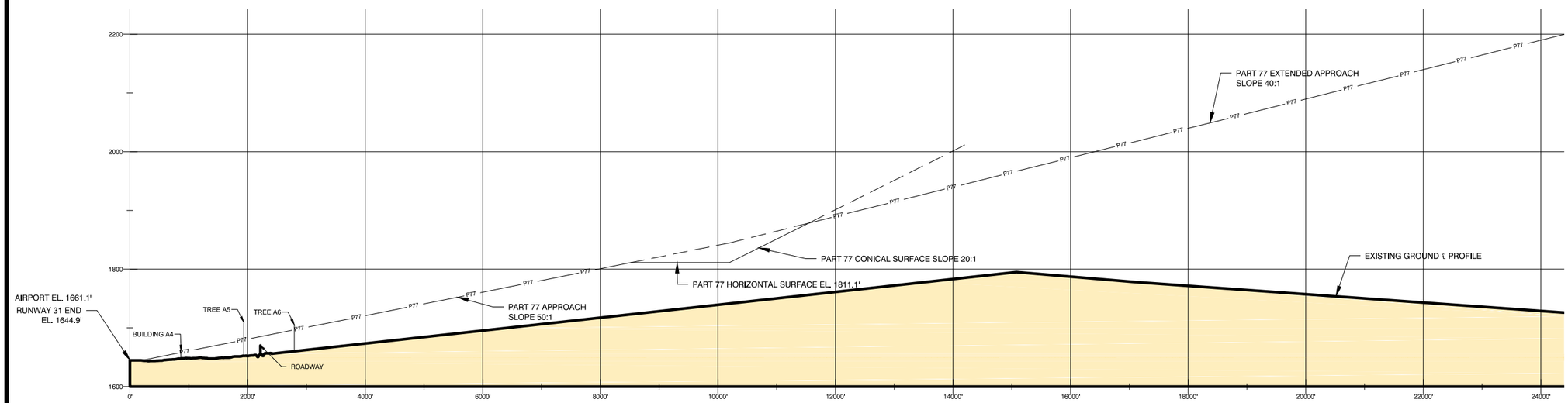
POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	OBJECT AGL HEIGHT	PART 77 SURFACE	PART 77 SURFACE ELEVATION	PART 77 PENETRATION	20:1 TSS SURFACE ELEVATION	TSS PENETRATION	DISPOSITION
A1	McKenzie Building	1816.2	120'	Horizontal	1,811.3'	4.9'	1,935.8'	-119.6'	Obstruction Light
A2	Tree	1706.5	59.6'	Approach	1,705.1'	1.4'	1,729.0'	-22.5'	Cut / Remove
A3	MALSR	1666.6	20.1'	Approach	1,665.1'	1.5'	1,670.0'	-3.4'	No Action
A4	MALSR/Generator Building	1661.1	12.6'	Approach	1,659.4'	1.7'	1,675.8'	-14.7'	Obstruction Light
A5	Tree	1710.5	57.9'	Approach	1,679.5'	31.0'	1,705.1'	5.4'	Cut / Remove
A6	Tree	1705.6	60.5'	Approach	1,705.5'	0.1'	1,729.7'	-24.1'	Cut / Remove
A7	Tree	1711.2	61.5'	Approach	1,683.4'	27.8'	1,697.1'	14.1'	Cut / Remove
A8	Tree	1711	60.0'	Approach	1,710.5'	0.5'	1,736.9'	-25.9'	Cut / Remove
A9	Tree	1742.9	60.0'	Approach	1,742.6'	0.3'	1,784.1'	-41.2'	Cut / Remove

TYPICAL FAR PART 77 SURFACES





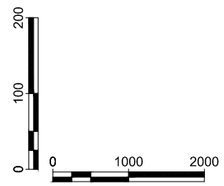
RUNWAY 13 APPROACH PROFILE



RUNWAY 31 APPROACH PROFILE

LEGEND: PROFILE VIEW

- Part 77 Surfaces
- P77 Part 77 Approach Surface
- Non Controlling Surface



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2301 UNIVERSITY DR., BISMARCK, ND 58504

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M&H PROJECT:	2716000-140293.01
AIP NO.:	3-38-003-055-2015
DATE:	JAN 2019
DESIGNED BY:	M&H
DRAWN BY:	JWB
CHECKED BY:	MRB

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SHEET CONTENTS

AIRPORT AIRSPACE - RUNWAY 13-31 PROFILES

SHEET NO. 7 of 22

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REVISIONS & NOTES

NO.	DESCRIPTION	DATE

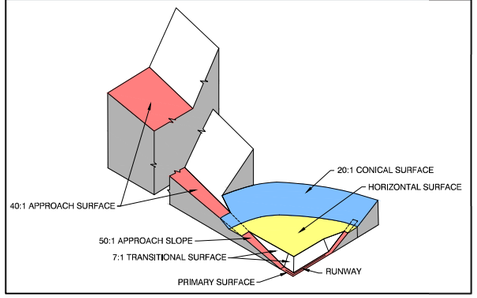
NOTES:

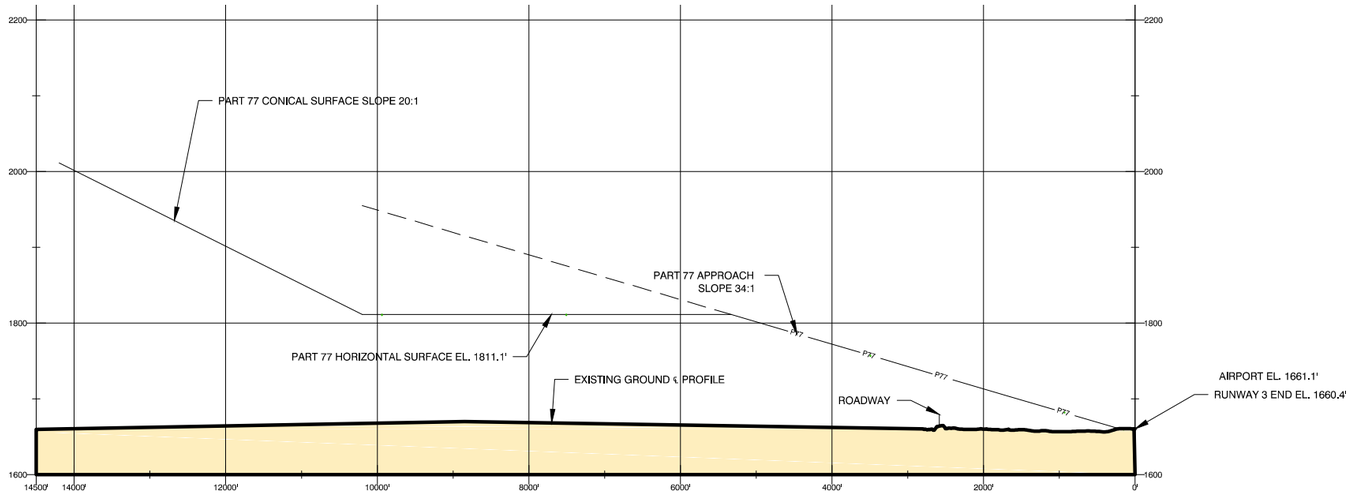
- Runway ends, Part 77 surface contours and obstruction elevations are shown in NAD83 and NAVD88. All elevations in feet above mean sea level (MSL).
- Object and runway end elevation source: AGIS Survey, Martinez Geospatial, November 2015.
- Basemap source: USGS Topographic maps.
- Only airspace surfaces associated with the existing runway and instrument approaches are illustrated (no changes proposed).
- See Inner-Approach Plan for close-in obstructions in RPZ areas and lateral transitional surfaces.
- See Departure Surfaces for 40:1 departure surfaces for each runway.
- For the Data Tables, a negative penetration value indicates the object is clear of the airspace surface.

PART 77 OBJECTS

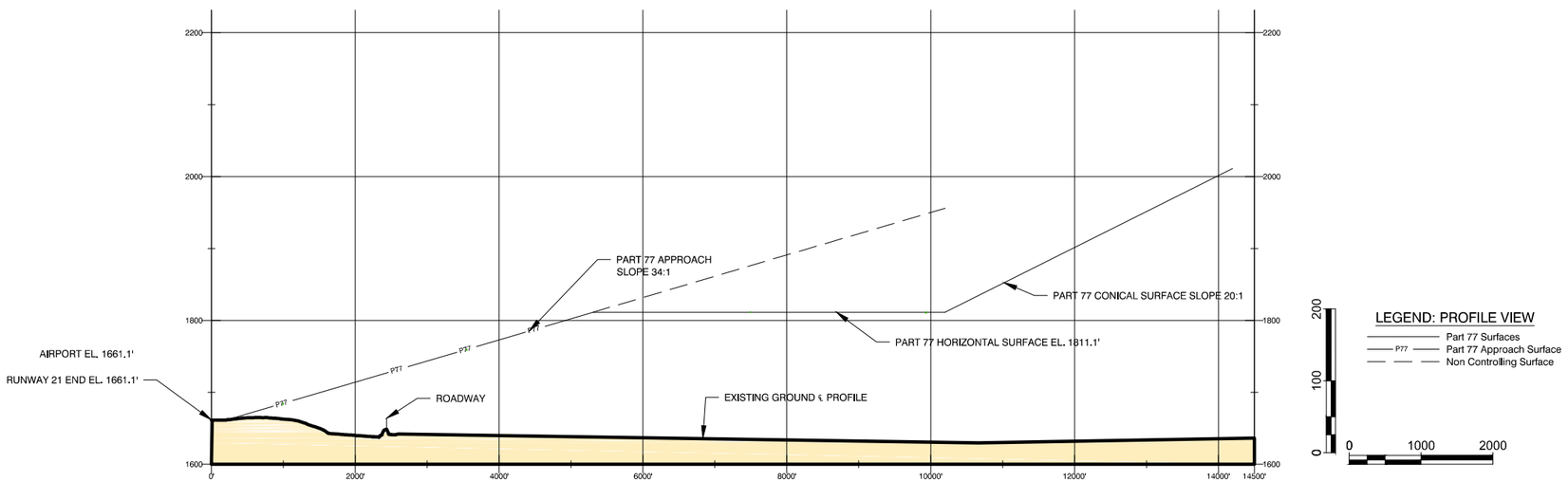
NO OBSTRUCTIONS IDENTIFIED WITHIN APPROACH AREA

TYPICAL FAR PART 77 SURFACES





RUNWAY 3 APPROACH PROFILE



RUNWAY 21 APPROACH PROFILE

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DRAWN BY: JWB
CHECKED BY: MRB
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SHEET CONTENTS

AIRPORT AIRSPACE - RUNWAY 3-21 PROFILES

SHEET NO. 8 of 22

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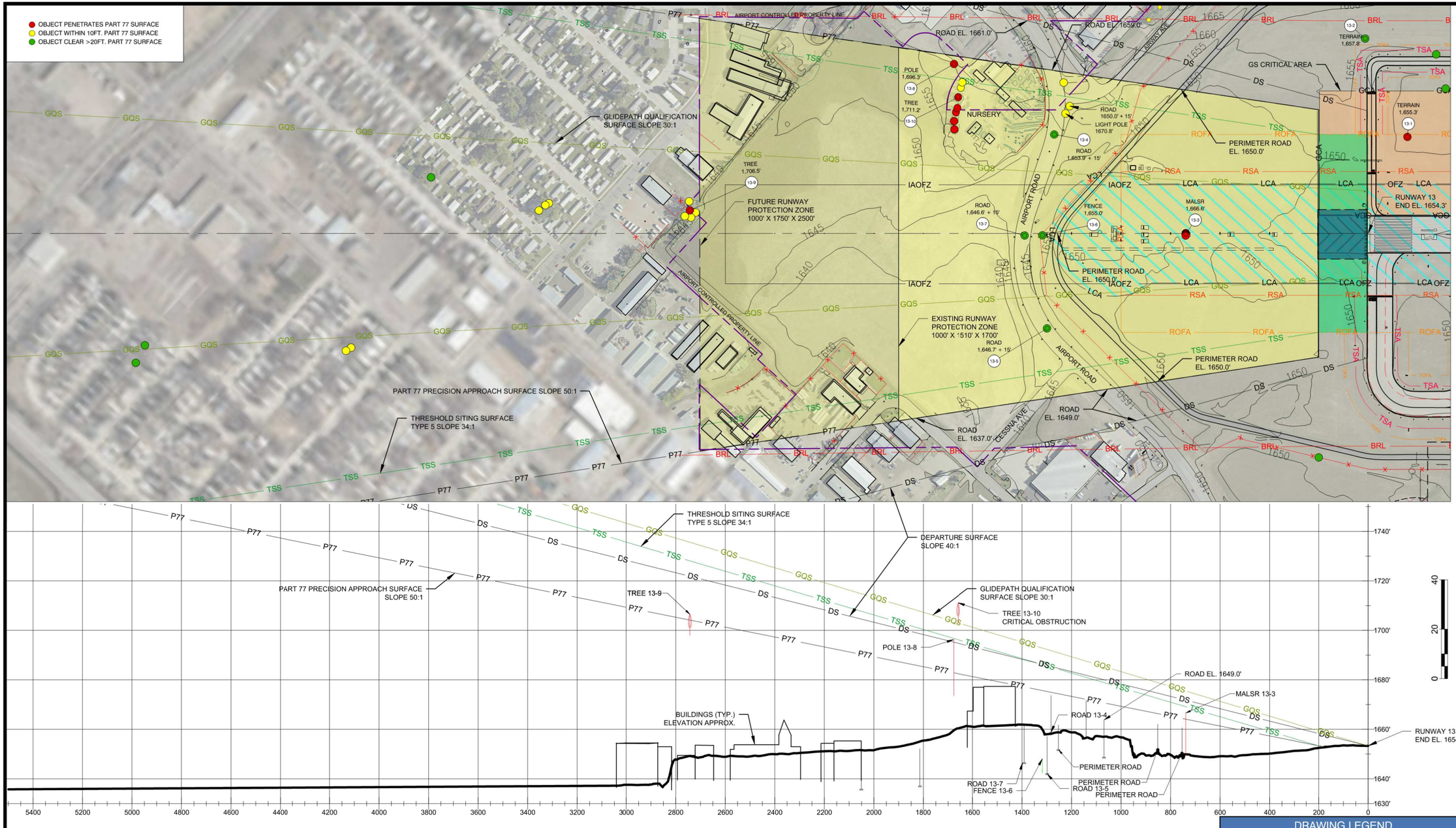


RUNWAY 13 OBJECT DATA

POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	OBJECT AGL HEIGHT	PART 77 SURFACE	50:1 PART 77 SURFACE ELEVATION	PART 77 PENETRATION	34:1 TSS SURFACE ELEVATION	TSS PENETRATION	30:1 GQS SURFACE ELEVATION	GQS PENETRATION	DISPOSITION ^
13-1	Terrain	1,655.3'	0'	Primary	1,654.3'	1.0'	Object Not Under Surface		Object Not Under Surface		To Be Removed
13-2	Terrain	1,657.8'	0'	Transitional	1,696.0'	-38.2'	Object Not Under Surface		Object Not Under Surface		To Be Removed
13-3	MALSR	1,666.6'	17.2'	Approach	1,665.0'	1.6'	1,670.0'	-3.4'	1,678.8'	-12.2'	No Action
13-4	Road	1,668.9'	15.0'	Approach	1,675.6'	-6.7'	1,685.6'	-16.7'	Object Not Under Surface		No Action
13-5	Road	1,661.7'	15.0'	Approach	1,676.2'	-14.5'	1,686.6'	-24.8'	Object Not Under Surface		No Action
13-6	Fence	1,655.0'	8.0'	Approach	1,676.6'	-21.6'	1,687.1'	-32.1'	1,698.1'	-43.1'	No Action
13-7	Road	1,651.6'	15.0'	Approach	1,678.0'	-26.4'	1,689.2'	-37.6'	1,700.5'	-48.9'	No Action
13-8	Pole	1,696.3'	41.3'	Approach	1,683.7'	12.6'	1,697.5'	-1.2'	1,709.9'	-13.6'	No Action
13-9	Tree	1,706.5'	57.4'	Approach	1,705.1'	1.4'	1,729.0'	-22.5'	1,745.6'	-39.1'	Cut / Remove
13-10	Trees	1,711.2'	56.2'	Approach	1,683.3'	27.9'	1,697.0'	14.2'	1,709.3'	1.9'	Cut / Remove

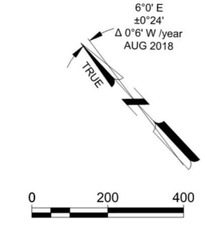
REVISIONS

NO.	DESCRIPTION	DATE

NOTES:

- Runway ends, Part 77 surface contours and obstruction elevations are shown in NAD83 and NAVD88. All elevations in feet above mean sea level (MSL).
- Object and runway end elevation source: AGIS Survey, Martinez Geospatial, November 2015.
- Basemap source: Aerial Imagery DIGITALGLOBE 2017.

OBJECT PENETRATES PART 77 SURFACE
OBJECT WITHIN 10FT. PART 77 SURFACE
OBJECT CLEAR >20FT. PART 77 SURFACE



DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT CONTROLLED PROPERTY LINE (FEE & EASEMENTS)		
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
PART 77 APPROACH SURFACE	P77	
THRESHOLD SITING SURFACE	TSS	
GQS SURFACE	GQS	
RUNWAY VISIBILITY ZONE	RVZ	
BUILDING RESTRICTION LINE	BRL	
OBSTACLE FREE ZONE	OFZ	
RUNWAY SAFETY AREA	RSA	
RUNWAY OBJECT FREE AREA	ROFA	
GLIDE SLOPE CRITICAL AREA (GCA)	GCA	
LOCALIZER CRICITAL AREA (LCA)	LCA	
AIRPORT SURVEILLANCE RADAR CRICITAL AREA (ACA)	ACA	
AIRPORT SECURITY FENCE 8'-10' (VARIES BY LOCATION)		
PRECISION OBSTACLE FREE ZONES (POFZ)		
GLIDE SLOPE CRITICAL AREA		
LOCALIZER CRITICAL AREA		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
VISUAL APPROACH SLOPE INDICATOR (VASI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		

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DRAWN BY: JWB
CHECKED BY: MRB
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SHEET CONTENTS

RUNWAY 13 INNER APPROACH PLAN & PROFILE

SHEET NO. 9 of 22

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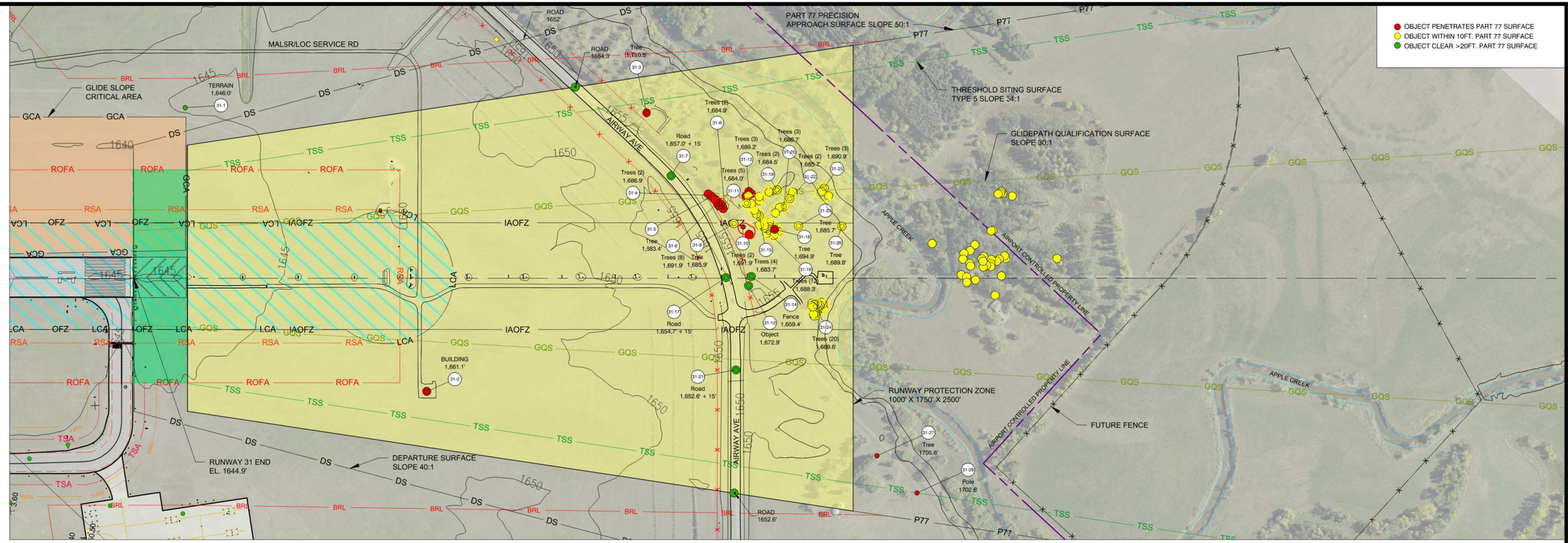

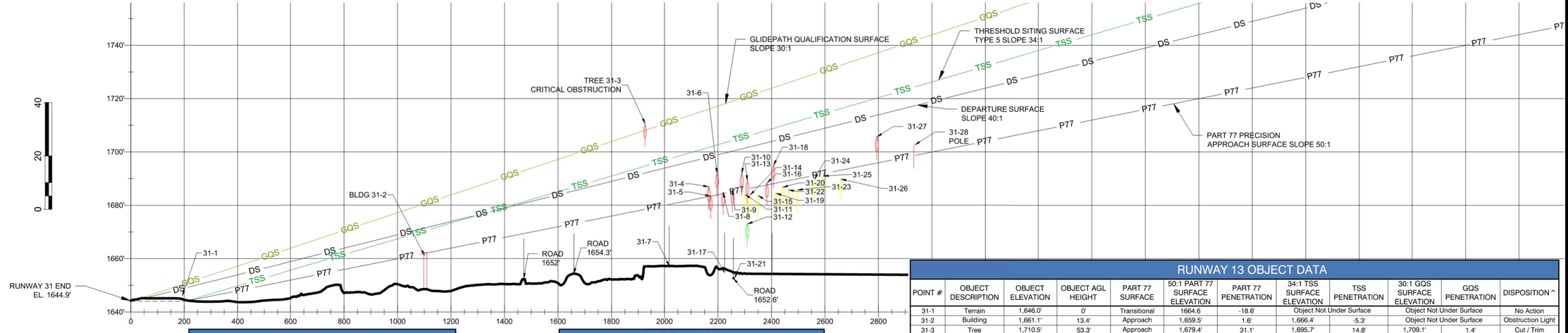

DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT CONTROLLED PROPERTY LINE (FEE & EASEMENTS)		
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
PART 77 APPROACH SURFACE	P77	
THRESHOLD SITING SURFACE	TSS	
GQS SURFACE	GQS	
RUNWAY VISIBILITY ZONE	RVZ	
BUILDING RESTRICTION LINE	BRL	
OBSTACLE FREE ZONE	OFZ	
RUNWAY SAFETY AREA	RSA	
RUNWAY OBJECT FREE AREA	ROFA	
GLIDE SLOPE CRITICAL AREA (GCA)	GCA	
LOCALIZER CRICITAL AREA (LCA)	LCA	
AIRPORT SURVEILLANCE RADAR CRICITAL AREA (ACA)	ACA	
AIRPORT SECURITY FENCE 8'-10' (VARIES BY LOCATION)	X	X
PRECISION OBSTACLE FREE ZONES (POFZ)		
GLIDE SLOPE CRITICAL AREA		
LOCALIZER CRITICAL AREA		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
VISUAL APPROACH SLOPE INDICATOR (VASI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		

REVISIONS

NO.	DESCRIPTION	DATE

NOTES:

- Runway ends, Part 77 surface contours and obstruction elevations are shown in NAD83 and NAVD88. All elevations in feet above mean sea level (MSL).
- Object and runway end elevation source: AGIS Survey, Martinez Geospatial, November 2015.
- Basemap source: Aerial Imagery DIGITALGLOBE 2017.

RUNWAY 13 OBJECT DATA

POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	OBJECT AGL HEIGHT	PART 77 SURFACE	50:1 PART 77 SURFACE ELEVATION	PART 77 PENETRATION	34:1 TSS SURFACE ELEVATION	TSS PENETRATION	30:1 GQS SURFACE ELEVATION	GQS PENETRATION	DISPOSITION ^
31-1	Terrain	1,646.0'	0'	Transitional	1664.6	-18.6'	Object Not Under Surface		Object Not Under Surface		No Action
31-2	Building	1,661.1'	13.4'	Approach	1,659.5'	1.6'	1,666.4'	-5.3'	Object Not Under Surface		Obstruction Light
31-3	Tree	1,710.5'	53.3'	Approach	1,679.4'	31.1'	1,695.7'	14.8'	1,709.1'	1.4'	Cut / Trim
31-4	Trees (2)	1,686.9'	32.9'	Approach	1,684.2'	2.7'	1,702.7'	-15.8'	Object Not Under Surface		Cut / Trim
31-5	Tree	1,683.4'	30.1'	Approach	1,684.4'	-1.0'	1,703.0'	-19.6'	1,717.4'	-34.0'	No Action
31-6	Trees (8)	1,691.9'	34.6'	Approach	1,684.9'	7.0'	1,703.7'	-11.8'	1,718.2'	-26.3'	Cut/Trim
31-7	Road	1,672.0'	15.0'	Approach	1,684.9'	-12.9'	1,703.7'	-31.7'	Object Not Under Surface		No Action
31-8	Trees (2)	1,684.9'	28.5'	Approach	1,685.3'	-0.4'	1,704.3'	-19.4'	1,718.9'	-34.0'	No Action
31-9	Tree	1,685.9'	31.2'	Approach	1,686.0'	-0.1'	1,705.4'	-19.5'	1,720.1'	-34.2'	No Action
31-10	Trees (2)	1,691.9'	37.6'	Approach	1,686.7'	5.2'	1,706.4'	-14.5'	1,721.2'	-29.3'	Cut/Trim
31-11	Trees (5)	1,684.0'	29.7'	Approach	1,687.0'	-3.0'	1,706.7'	-22.7'	1,721.7'	-37.7'	No Action
31-12	Object	1,672.9'	18.7'	Approach	1,687.1'	-14.2'	1,707.0'	-34.1'	1,721.9'	-49.0'	No Action
31-13	Trees (3)	1,689.2'	35.2'	Approach	1,687.1'	2.1'	1,707.0'	-17.8'	1,722.0'	-32.8'	Cut/Trim
31-14	Fence	1,659.4'	8'	Approach	1,687.3'	-27.9'	1,707.2'	-47.8'	1,722.2'	-62.8'	No Action
31-15	Trees (4)	1,683.7'	29.5'	Approach	1,687.9'	-4.2'	1,708.2'	-24.5'	1,723.3'	-39.6'	No Action
31-16	Trees (12)	1,688.3'	34.0'	Approach	1,688.6'	-0.3'	1,709.1'	-20.8'	1,724.4'	-36.1'	No Action
31-17	Road	1,669.7'	15.0'	Approach	1,689.0'	-19.3'	1,709.7'	-40.0'	1,725.0'	-55.3'	No Action
31-18	Tree	1,694.9'	40.6'	Approach	1,689.1'	5.8'	1,709.9'	-15.0'	1,725.2'	-30.3'	Cut/Trim
31-19	Trees (2)	1,684.5'	30.3'	Approach	1,689.3'	-4.8'	1,710.1'	-25.6'	1,725.5'	-41.0'	No Action
31-20	Trees (3)	1,686.7'	32.4'	Approach	1,689.8'	-3.1'	1,710.9'	-24.2'	1,726.3'	-39.6'	No Action
31-21	Road	1,667.6'	15.0'	Approach	1,689.8'	-22.2'	1,710.9'	-43.3'	Object Not Under Surface		No Action
31-22	Trees (2)	1,685.7'	31.7'	Approach	1,690.2'	-4.5'	1,711.5'	-25.8'	1,727.1'	-41.4'	No Action
31-23	Tree	1,685.7'	31.7'	Approach	1,690.9'	-5.2'	1,712.5'	-26.8'	1,728.2'	-42.5'	No Action
31-24	Trees (20)	1,689.6'	35.4'	Approach	1,692.1'	-2.5'	1,714.4'	-24.8'	1,730.3'	-40.7'	No Action
31-25	Trees (3)	1,690.9'	36.9'	Approach	1,692.8'	-1.9'	1,715.3'	-24.4'	1,731.4'	-40.5'	No Action
31-26	Tree	1,689.8'	35.8'	Approach	1,694.1'	-4.3'	1,717.3'	-27.5'	1,733.6'	-43.8'	No Action
31-27	Tree	1,705.6'	65.0'	Approach	1,696.1'	9.5'	1,720.3'	-14.7'	1,737.0'	-31.4'	No Action
31-28	Pole	1,702.6'	48.8'	Approach	1,698.9'	3.7'	1,724.4'	-21.8'	1,741.6'	-39.0'	No Action

6°0' E
±0°24'
Δ 0°6' W /year
AUG 2018
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0 200 400

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SHEET CONTENTS
RUNWAY 31 INNER APPROACH PLAN & PROFILE

SHEET NO. 10 of 22

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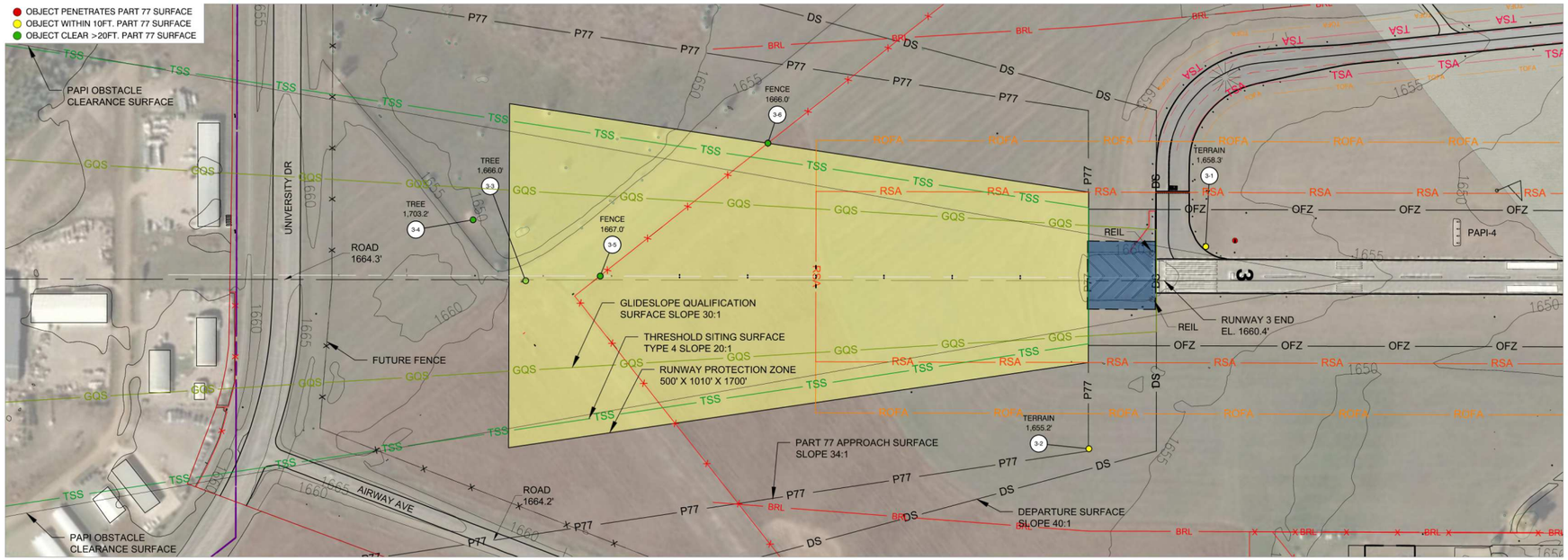
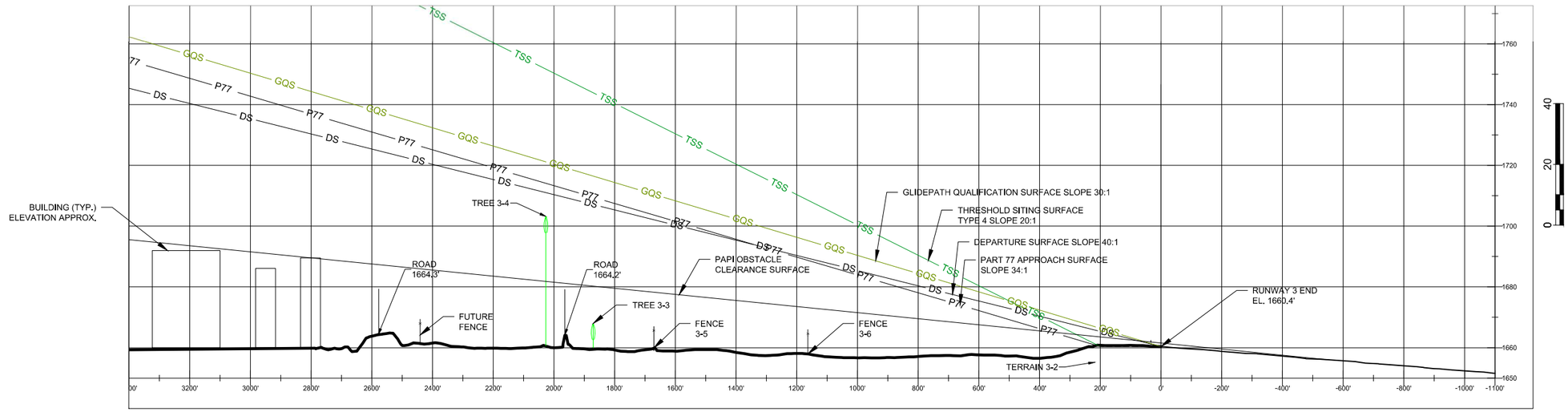


RUNWAY 3 INNER APPROACH PLAN



RUNWAY 3 INNER APPROACH PROFILE

RUNWAY 3 OBJECT DATA

POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	OBJECT AGL HEIGHT	PART 77 SURFACE	34:1 PART 77 SURFACE ELEVATION	PART 77 PENETRATION	20:1 TSS SURFACE ELEVATION	TSS PENETRATION	30:1 GQS SURFACE ELEVATION	GQS PENETRATION	DISPOSITION ^
3-1	Terrain	1658.30	0'	Primary	1,660.4'	-2.1'	Object Not Under Surface		Object Not Under Surface		No Action
3-2	Terrain	1655.20	0'	Approach	1,660.2'	-5.0'	1660.1	-4.9	Object Not Under Surface		No Action
3-3	Tree	1666.00	8'	Approach	1,709.6'	-43.6'	1744.0	-78.0	1722.8	-56.8	No Action
3-4	Tree	1703.20	42.5'	Approach	1,713.4'	-10.2'	1750.6	-47.4	1727.2	-24.0	No Action
3-5	Fence	1667.00	8'	Approach	1,703.6'	-36.6'	1733.9	-66.9	1710.5	-43.5	No Action
3-6	Fence	1666.00	8'	Approach	1,688.7'	-22.7'	1708.6	-42.6	1695.3	-29.3	No Action

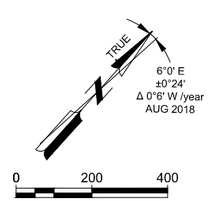
REVISIONS

NO.	DESCRIPTION	DATE

NOTES:

- Runway ends, Part 77 surface contours and obstruction elevations are shown in NAD83 and NAVD88. All elevations in feet above mean sea level (MSL).
- Object and runway end elevation source: AGIS Survey, Martinez Geospatial, November 2015.
- Basemap source: Aerial Imagery DIGITALGLOBE 2017.

OBJECT PENETRATES PART 77 SURFACE
OBJECT WITHIN 10FT. PART 77 SURFACE
OBJECT CLEAR >20FT. PART 77 SURFACE



DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT CONTROLLED PROPERTY LINE (FEE & EASEMENTS)		
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
PART 77 APPROACH SURFACE	P77	
THRESHOLD SITING SURFACE	TSS	
GQS SURFACE	GQS	
RUNWAY VISIBILITY ZONE	RVZ	
BUILDING RESTRICTION LINE	BRL	
OBSTACLE FREE ZONE	OFZ	
RUNWAY SAFETY AREA	RSA	
RUNWAY OBJECT FREE AREA	ROFA	
GLIDE SLOPE CRITICAL AREA (GCA)	GCA	
LOCALIZER CRICITAL AREA (LCA)	LCA	
AIRPORT SURVEILLANCE RADAR CRICITAL AREA (ACA)	ACA	
AIRPORT SECURITY FENCE 8'-10' (VARIES BY LOCATION)		
PRECISION OBSTACLE FREE ZONES (POFZ)		
GLIDE SLOPE CRITICAL AREA		
LOCALIZER CRITICAL AREA		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
VISUAL APPROACH SLOPE INDICATOR (VASI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		

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BISMARCK AIRPORT

2301 UNIVERSITY DR., BISMARCK, ND 58504

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M&H PROJECT: 2716000-140293.01
AIP NO.: 3-38-003-055-2015
DATE: JAN 2019
DESIGNED BY: M&H
DRAWN BY: JWB
CHECKED BY: MRB
DO NOT SCALE DRAWINGS

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RUNWAY 3 INNER APPROACH PLAN & PROFILE

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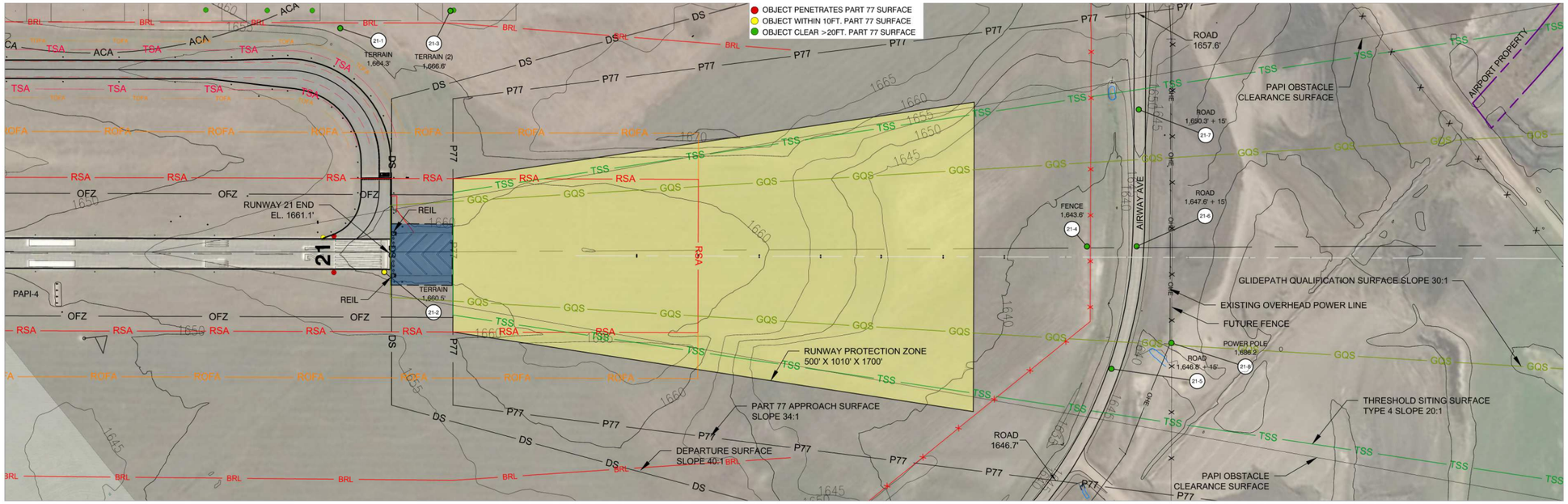
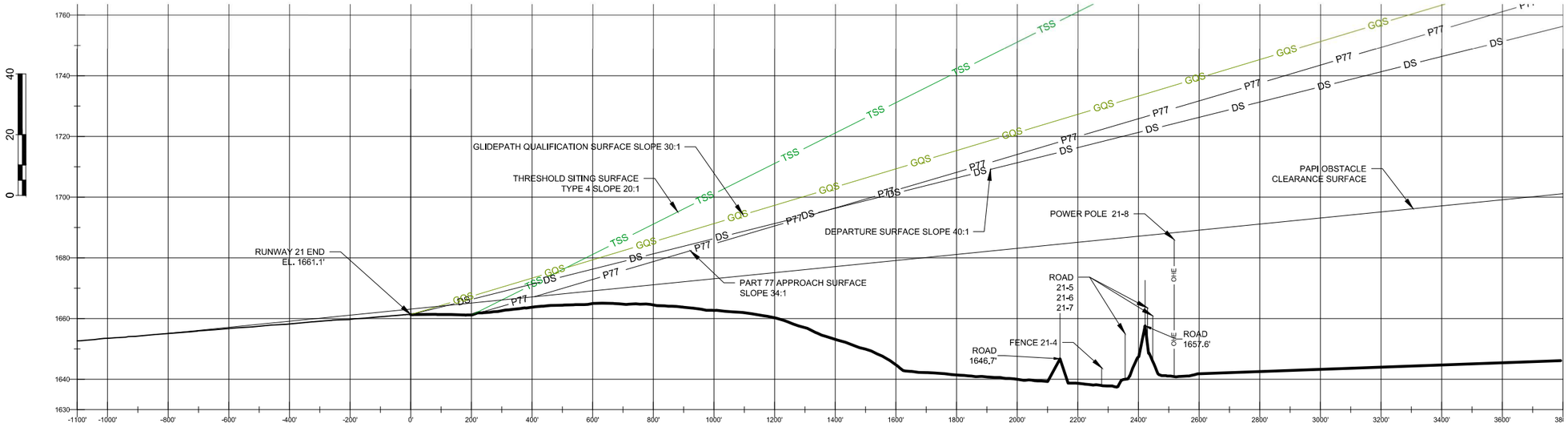


RUNWAY 21 INNER APPROACH PLAN



RUNWAY 21 INNER APPROACH PROFILE

RUNWAY 21 OBJECT DATA

POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	OBJECT AGL HEIGHT	PART 77 SURFACE	34:1 PART 77 SURFACE ELEVATION	PART 77 PENETRATION	20:1 TSS SURFACE ELEVATION	TSS PENETRATION	30:1 GQS SURFACE ELEVATION	GQS PENETRATION	DISPOSITION ^
21-1	Terrain	1664.30	0'	Transitional	1694.2	-29.9'	Object Not Under Surface		Object Not Under Surface		No Action
21-2	Terrain	1660.50	0'	Primary	1661.1	-0.6'	Object Not Under Surface		Object Not Under Surface		No Action
21-3	Terrain (2)	1666.60	0'	Transitional	1702.1	-35.5'	Object Not Under Surface		Object Not Under Surface		No Action
21-4	Fence	1643.60	8'	Approach	1,726.4'	-82.8'	1,772.1'	-128.5'	1,741.8'	-98.2'	No Action
21-5	Road	1661.80	15'	Approach	1,728.7'	-66.9'	1,776.1'	-114.3'	1,744.4'	-82.6'	No Action
21-6	Road	1662.60	15'	Approach	1,731.2'	-68.6'	1,780.2'	-117.6'	1,747.2'	-84.6'	No Action
21-7	Road	1665.30	15'	Approach	1,731.4'	-66.1'	1,780.6'	-115.3'	1,747.4'	-82.1'	No Action
21-8	Power Pole	1686.20	46'	Approach	1,730.1'	-43.9'	1,778.4'	-92.2'	1,746.0'	-59.7'	No Action

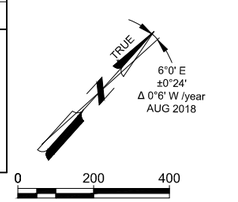
REVISIONS

NO.	DESCRIPTION	DATE

NOTES:

- Runway ends, Part 77 surface contours and obstruction elevations are shown in NAD83 and NAVD88. All elevations in feet above mean sea level (MSL).
- Object and runway end elevation source: AGIS Survey, Martinez Geospatial, November 2015.
- Basemap source: Aerial Imagery DIGITALGLOBE 2017.

OBJECT PENETRATES PART 77 SURFACE
OBJECT WITHIN 10FT. PART 77 SURFACE
OBJECT CLEAR >20FT. PART 77 SURFACE



DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT CONTROLLED PROPERTY LINE (FEE & EASEMENTS)		
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
PART 77 APPROACH SURFACE	P77	
THRESHOLD SITING SURFACE	TSS	
GQS SURFACE	GQS	
RUNWAY VISIBILITY ZONE	RVZ	
BUILDING RESTRICTION LINE	BRL	
OBSTACLE FREE ZONE	OFZ	
RUNWAY SAFETY AREA	RSA	
RUNWAY OBJECT FREE AREA	ROFA	
GLIDE SLOPE CRITICAL AREA (GCA)	GCA	
LOCALIZER CRICITAL AREA (LCA)	LCA	
AIRPORT SURVEILLANCE RADAR CRICITAL AREA (ACA)	ACA	
AIRPORT SECURITY FENCE 8'-10' (VARIES BY LOCATION)		
PRECISION OBSTACLE FREE ZONES (POFZ)		
GLIDE SLOPE CRITICAL AREA		
LOCALIZER CRITICAL AREA		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
VISUAL APPROACH SLOPE INDICATOR (VASI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		
OVERHEAD POWER LINE		

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2301 UNIVERSITY DR., BISMARCK, ND 58504

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DRAWN BY: JWB
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SHEET CONTENTS

RUNWAY 21 INNER APPROACH PLAN & PROFILE

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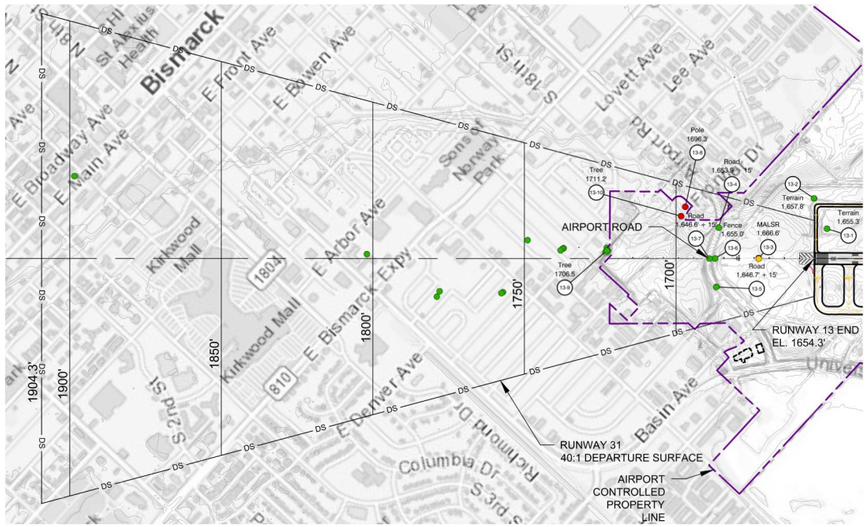
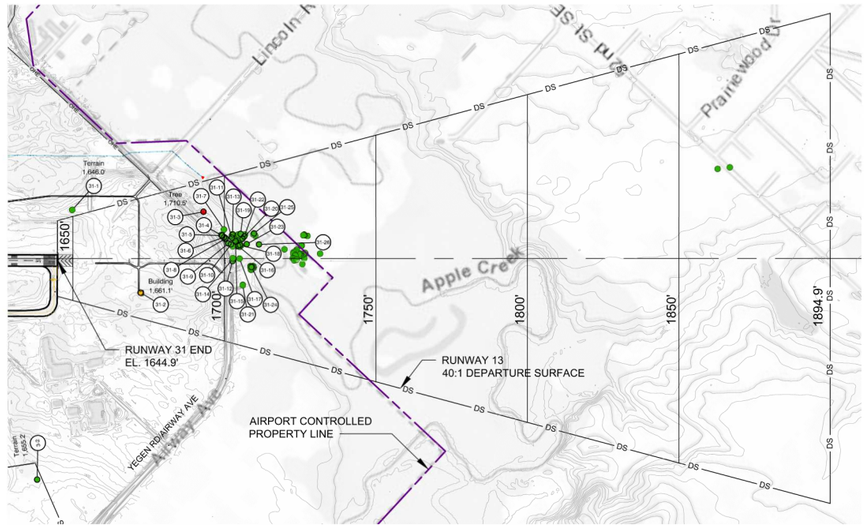


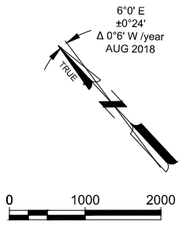
RUNWAY 31 DEPARTURE SURFACE PLAN

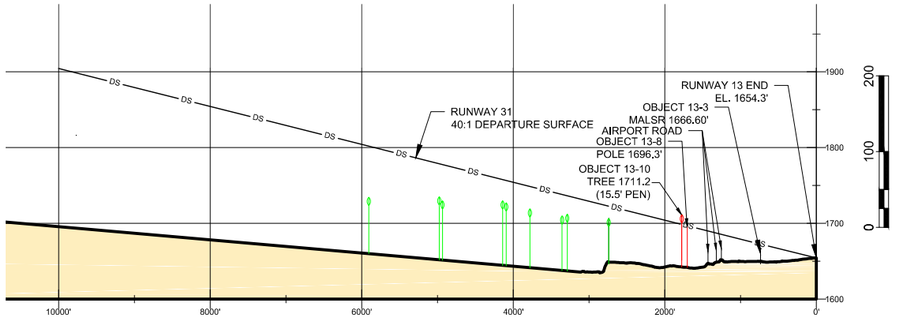


RUNWAY 13 DEPARTURE SURFACE PLAN

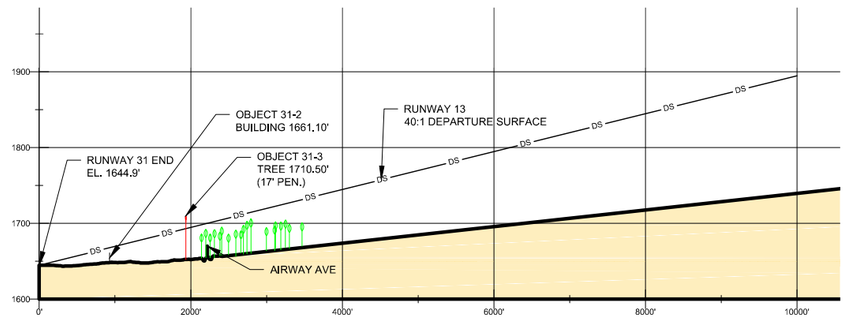
LEGEND: PLAN VIEW

- Airport Controlled Property Line (Fee & Easements)
- DS — Departure Surface
- Object Penetrates Departure Surface
- Object Within 10ft. Departure Surface
- Object Clear >10ft. Departure Surface





RUNWAY 31 DEPARTURE SURFACE PROFILE



RUNWAY 13 DEPARTURE SURFACE PROFILE

LEGEND: PROFILE VIEW

- DS — 40:1 Departure Surface

RUNWAY 13 OBJECT DATA

POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	40:1 DEPARTURE SURFACE ELEVATION	DEPARTURE SURFACE PENETRATION
13-1	Terrain	1655.3	1,650.2'	5.1'
13-2	Terrain	1657.8	1,654.5'	3.3'
13-3	MALSR	1666.6	1,672.7'	-6.1'
13-4	Road	1668.9	1,685.9'	-17.0'
13-5	Road	1661.7	1,686.7'	-25.0'
13-6	Fence	1655.0	1,687.1'	-32.1'
13-7	Road	1651.6	1,688.9'	-37.3'
13-8	Pole	1696.3	1,696.0'	0.3'
13-9	Tree	1706.5	1,722.8'	-16.3'
13-10	Tree	1711.20	1,695.7'	15.5'

RUNWAY 31 OBJECT DATA

POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	40:1 DEPARTURE SURFACE ELEVATION	DEPARTURE SURFACE PENETRATION
31-1	Terrain	1646	1,649.8'	-3.8'
31-2	Building	1661.1	1,668.2'	-7.1'
31-3	Tree	1710.5	1,693.1'	17.4'
31-4	Trees (2)	1686.9	1,699.1'	-12.2'
31-5	Tree	1683.4	1,699.2'	-15.8'
31-6	Trees (8)	1691.9	1,699.8'	-7.9'
31-7	Road	1672	1,699.9'	-27.9'
31-8	Trees (2)	1684.9	1,700.4'	-15.5'
31-9	Tree	1685.9	1,701.3'	-15.4'
31-10	Trees (2)	1691.9	1,702.2'	-10.3'
31-11	Trees (5)	1684	1,702.5'	-18.5'
31-12	Object	1672.9	1,702.7'	-29.8'
31-13	Trees (3)	1689.2	1,702.7'	-13.5'
31-14	Fence	1659.4	1,702.9'	-43.5'
31-15	Trees (4)	1683.7	1,703.7'	-20.0'
31-16	Trees (12)	1688.3	1,704.5'	-16.2'
31-17	Road	1669.7	1,705.0'	-35.3'
31-18	Tree	1694.9	1,705.1'	-10.2'
31-19	Trees (2)	1684.5	1,705.3'	-20.8'
31-20	Trees (3)	1686.7	1,706.0'	-19.3'
31-21	Road	1667.6	1,706.0'	-38.4'
31-22	Trees (2)	1685.7	1,706.5'	-20.8'
31-23	Tree	1685.7	1,707.3'	-21.6'
31-24	Trees (20)	1689.6	1,709.0'	-19.4'
31-25	Trees (3)	1690.9	1,709.8'	-18.9'
31-26	Tree	1689.8	1,711.4'	-21.6'

DEPARTURE SURFACE AGIS OBJECTS

		DEPARTURE SURFACE	
		RUNWAY 31	RUNWAY 13
●	# OBJECTS THAT PENETRATE DEPARTURE SURFACE	0	1
●	# OBJECTS WITHIN 10 FEET OF DEPARTURE SURFACE	5	1
●	# OBJECTS > 10 FEET CLEAR OF DEPARTURE SURFACE	15	106

REVISIONS

NO.	DESCRIPTION	DATE

NOTES:

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- Object and runway end elevation source: AGIS Survey, Martinez Geospatial, November 2015.
- Basemap source: USGS Topographic maps.

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SHEET CONTENTS

RUNWAY 13-31
DEPARTURE
SURFACES

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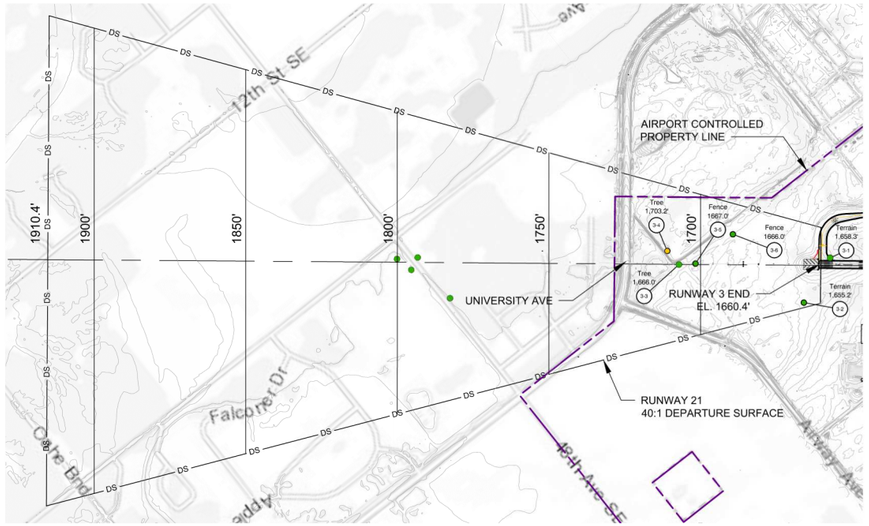
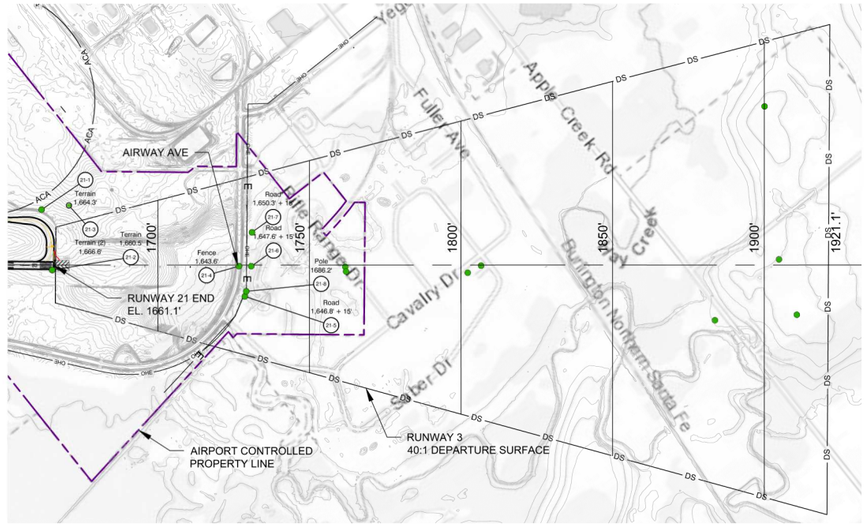


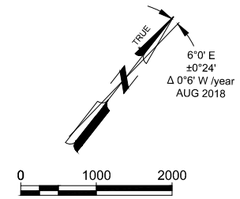
RUNWAY 21 DEPARTURE SURFACE PLAN

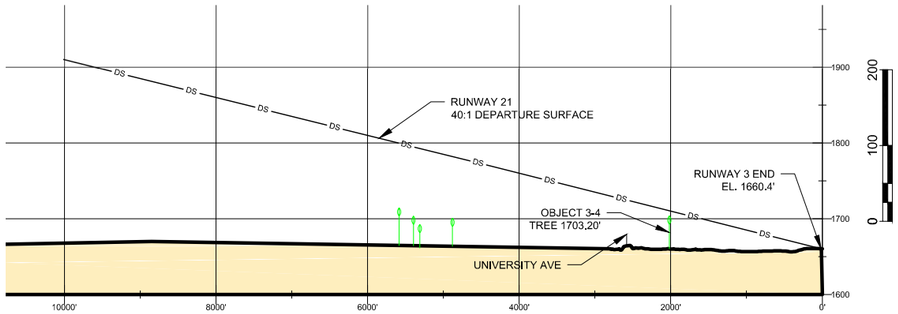


RUNWAY 3 DEPARTURE SURFACE PLAN

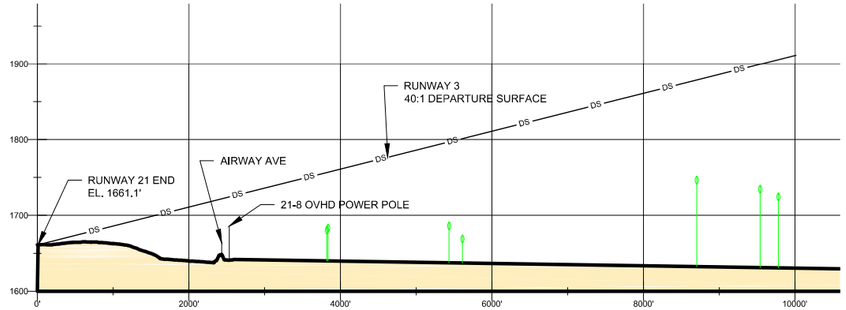
LEGEND: PLAN VIEW

- Airport Controlled Property Line (Fee & Easements)
- DS — Departure Surface
- Object Penetrates Departure Surface
- Object Within 10ft. Departure Surface
- Object Clear >10ft. Departure Surface





RUNWAY 21 DEPARTURE SURFACE PROFILE



RUNWAY 3 DEPARTURE SURFACE PROFILE

LEGEND: PROFILE VIEW

DS — 40:1 Departure Surface

RUNWAY 3 OBJECT DATA

POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	40:1 DEPARTURE SURFACE ELEVATION	DEPARTURE SURFACE PENETRATION
3-1	Terrain	1658.3	1,656.7'	1.6'
3-2	Terrain	1655.2	1,665.3'	-10.1'
3-3	Tree	1666.0	1,707.2'	-41.2'
3-4	Tree	1703.2	1,710.5'	-7.3'
3-5	Fence	1667.00	1,701.2'	-34.2'
3-6	Fence	1666.00	1,688.9'	-22.9'

RUNWAY 21 OBJECT DATA

POINT #	OBJECT DESCRIPTION	OBJECT ELEVATION	40:1 DEPARTURE SURFACE ELEVATION	DEPARTURE SURFACE PENETRATION
21-1	Terrain	1664.3	1,656.8'	7.5'
21-2	Terrain	1660.5	1,660.6'	-0.1'
21-3	Terrain (2)	1666.6	1,665.9'	0.7'
21-4	Fence	1643.6	1,721.6'	-78.0'
21-5	Road	1661.8	1,723.6'	-61.8'
21-6	Road	1662.6	1,725.7'	-63.1'
21-7	Road	1665.3	1,725.8'	-60.5'
21-8	Power Pole	1686.2	1,724.7'	-38.5'

DEPARTURE SURFACE AGIS OBJECTS

		DEPARTURE SURFACE	
		RUNWAY 21	RUNWAY 3
●	# OBJECTS THAT PENETRATE PART 77 SURFACE	0	0
●	# OBJECTS WITHIN 10 FEET OF PART 77 SURFACE	1	0
●	# OBJECTS > 10 FEET CLEAR OF PART 77 SURFACE	5	8

REVISIONS

NO.	DESCRIPTION	DATE

NOTES:

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- Basemap source: USGS Topographic maps.

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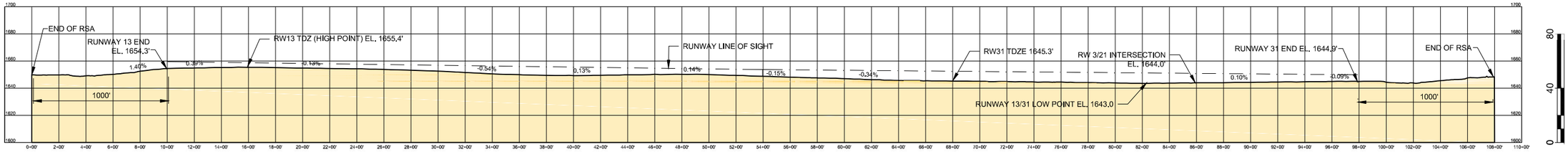
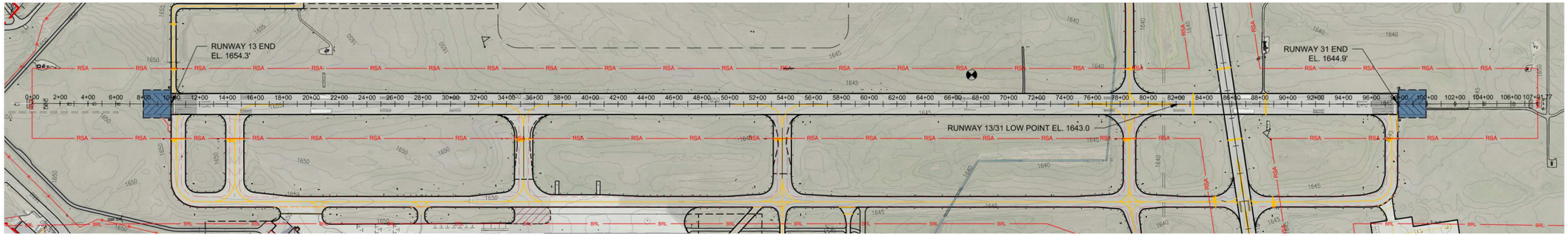
RUNWAY 13/31 CENTERLINE PROFILE (2015 PRE-CONSTRUCTION)



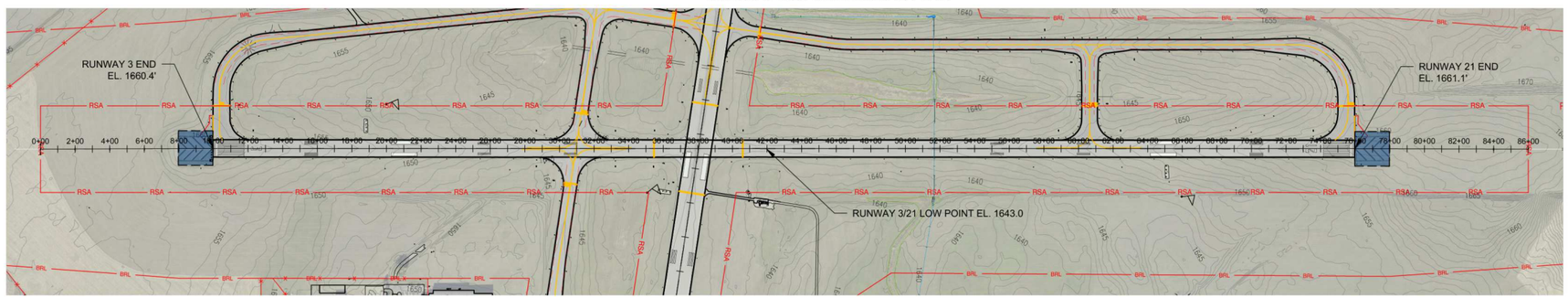


RUNWAY 13/31 CENTERLINE PLAN

6°0' E
±0°24'
Δ 0°6' W /year
AUG 2018
TRUE
0 400 800

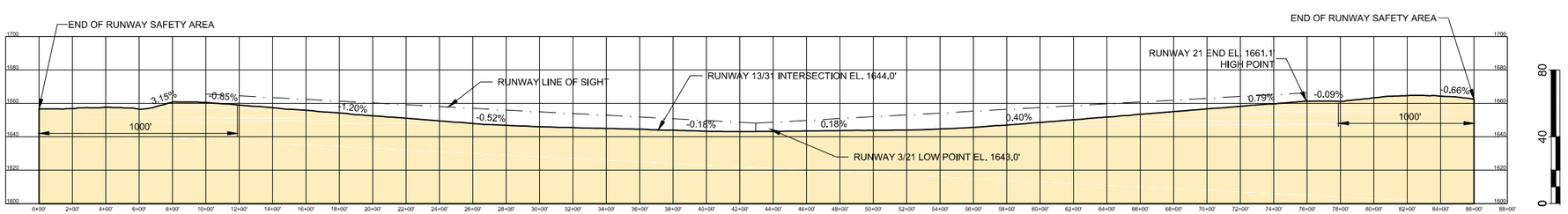
REVISIONS & NOTES		
NO.	DESCRIPTION	DATE
NOTES:		

RUNWAY 3/21 CENTERLINE PLAN



6°0' E
±0°24'
Δ 0°6' W /year
AUG 2018
TRUE
0 400 800

DRAWING LEGEND	EXISTING	FUTURE
AIRPORT CONTROLLED PROPERTY LINE (FEE&EASEMENTS)		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
RUNWAY VISIBILITY ZONE	RVZ	
BUILDING RESTRICTION LINE	BRL	
RUNWAY SAFETY AREA	RSA	
AIRPORT SECURITY FENCE (8 feet)		
PRECISION OBSTACLE FREE ZONES (POFZ)		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
VISUAL APPROACH SLOPE INDICATOR (VASI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		



RUNWAY 3/21 CENTERLINE PROFILE

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CITY OF BISMARCK
BISMARCK AIRPORT LAYOUT PLAN

2301 UNIVERSITY DR., BISMARCK, ND 58504

ISSUED

NOT FOR CONSTRUCTION

M&H PROJECT:
AIP NO.: 3-38-003-055-2015
DATE: JAN 2019
DESIGNED BY: M&H
DRAWN BY: JWB
CHECKED BY: MRB
DO NOT SCALE DRAWINGS

SHEET CONTENTS
RUNWAY CENTERLINE PROFILES

SHEET NO.
15 of 22

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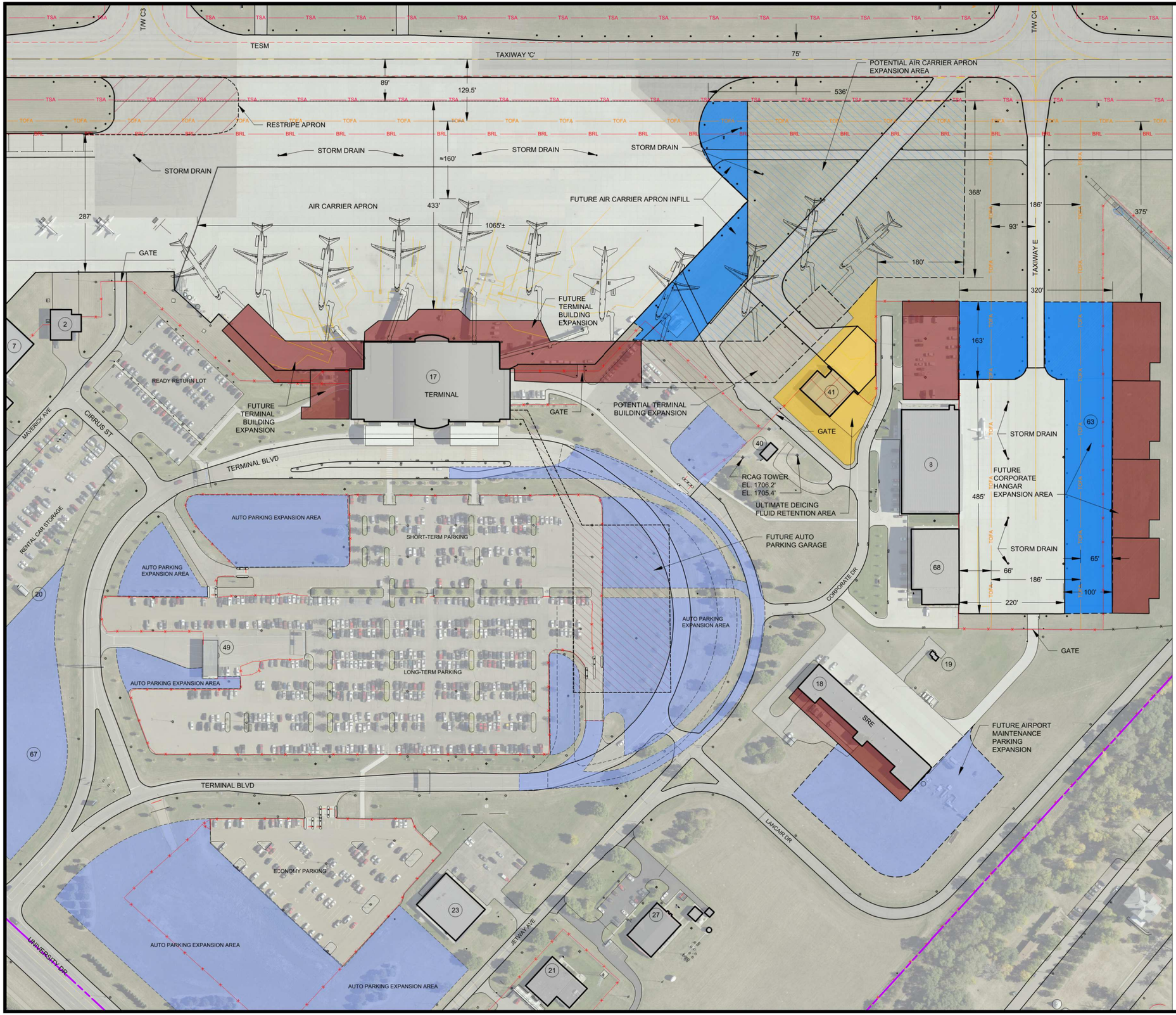


REVISIONS & NOTES

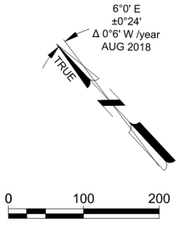
NO.	DESCRIPTION	DATE

NOTES:

BUILDING LEGEND

EXT	ULT	DESCRIPTION	TOP ELEV.
2		OPS BLDG/EMERGENCY GENERATOR	1665.2'
7		BIS AERO CENTER HANGAR	1671.5'
8		CORP. HANGAR/OFFICE	1679.8'
17		AIRLINE TERMINAL/AIRPORT ADMIN BUILDING	1717.0'
18		AIRPORT MAINTENANCE BUILDING	1675.7'
19		LIFT STATION #2	1658.8'
20		LIFT STATION #1	1660.4'
21		EMER. MANAGEMENT & COMBINED COMM. CENTER	1670.3'
23		FAA DAK-MINN ADO OFFICE / TECH OPS	1693.9'
27		NATIONAL WEATHER SERVICE	1676.6'
40		FAA REMOTE TRANSMITTER/RCAG TOWERS	1657.5'
41*		CITY HANGAR (TO BE REMOVED)	1671.7'
48		EXECUTIVE AIR TAXI	1676.3'
49		EXISTING PAY PARKING LOT EXIT PLAZA	1672.6'
	63	CORPORATE AVIATION AREA	
	67	RENTAL CAR STORAGE LOT	
68		CORP. HANGAR/OFFICE	1680.8'

* TO BE REMOVED OR RELOCATED



DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT CONTROLLED PROPERTY LINE (FEE&EASEMENTS)		
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
FUTURE PAVED ROADS / PARKING		
RUNWAY PROTECTION ZONE		
RUNWAY VISIBILITY ZONE	RVZ	
BUILDING RESTRICTION LINE	BRL	
RUNWAY SAFETY AREA	RSA	
RUNWAY OBJECT FREE AREA	ROFA	
GLIDE SLOPE CRITICAL AREA (GCA)	GCA	
LOCALIZER CRICITAL AREA (LCA)	LCA	
AIRPORT SURVEILLANCE RADAR CRICITAL AREA (ACA)	ACA	
AIRPORT SECURITY FENCE (8 feet)		
PRECISION OBSTACLE FREE ZONES (POFZ)		
FUEL STORAGE AREA		
AIRPORT BEACON		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
VISUAL APPROACH SLOPE INDICATOR (VASI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		
AIRPORT REFERENCE POINT (ARP)		
FUTURE DEVELOPMENT AREA		
TAXIWAY EDGE SAFETY MARGIN (TESM)		

Mead & Hunt

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SHEET CONTENTS
TERMINAL AREA PLAN

SHEET NO. 16 of 22

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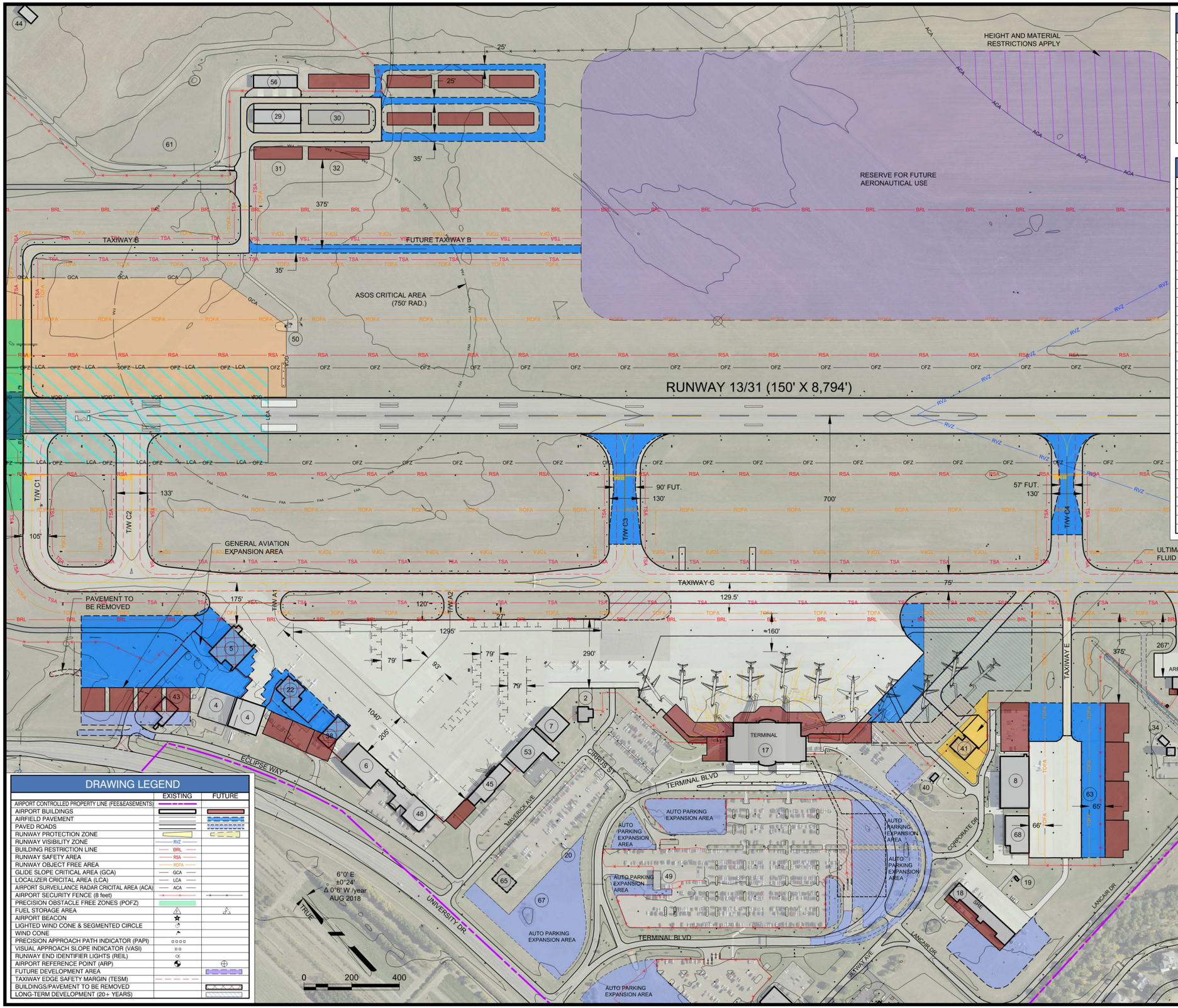

DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT CONTROLLED PROPERTY LINE (FEE&EASEMENTS)		
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
RUNWAY VISIBILITY ZONE	RVZ	
BUILDING RESTRICTION LINE	BRL	
RUNWAY SAFETY AREA	RSA	
RUNWAY OBJECT FREE AREA	ROFA	
GLIDE SLOPE CRITICAL AREA (GCA)	GCA	
LOCALIZER CRICITAL AREA (LCA)	LCA	
AIRPORT SURVELLANCE RADAR CRICITAL AREA (ACA)	ACA	
AIRPORT SECURITY FENCE (8 feet)		
PRECISION OBSTACLE FREE ZONES (POFZ)		
FUEL STORAGE AREA		
AIRPORT BEACON		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
VISUAL APPROACH SLOPE INDICATOR (VASI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		
AIRPORT REFERENCE POINT (ARP)		
FUTURE DEVELOPMENT AREA		
TAXIWAY EDGE SAFETY MARGIN (TESM)		
BUILDINGS/PAVEMENT TO BE REMOVED		
LONG-TERM DEVELOPMENT (20+ YEARS)		

REVISIONS & NOTES

NO.	DESCRIPTION	DATE

NOTES:

BUILDING LEGEND

EXT	ULT	DESCRIPTION	TOP ELEV.
2		OPS BLDG/EMERGENCY GENERATOR	1665.2'
4		BIS AERO CENTER HANGAR	1671.5'
5*		CITY HANGAR (TO BE REMOVED)	1690.9'
6		EXECUTIVE AIR TAXI	1696.5'
7		BIS AERO CENTER HANGAR	1671.5'
14		AIRPORT FIRE DEPARTMENT (ARFF)	1685.6'
17		AIRLINE TERMINAL BUILDING	1717.0'
18		AIRPORT MAINTENANCE BUILDING	1675.7'
19		LIFT STATION #2	1658.8'
20		LIFT STATION #1	1660.4'
22*		FBO/NDAC (TO BE RELOCATED)	1669.6'
29		AEROSTOR CONDO #1	1677.8'
30		AREA 51 HANGAR ASSOCIATION	
	31	T-HANGAR SITE C	
	32	T-HANGAR SITE D	
34		FAA ATCT GARAGE & EMERGENCY GENERATOR	1660.9'
37		BISMARCK AERO CENTER FUEL FARM	1673.0'
38*		WAY-POINT AVIONICS (TO BE REMOVED)	1677.2'
40		FAA REMOTE TRANSMITTER	1657.5'
41*		NDDOT HANGAR (TO BE REMOVED)	1671.7'
43*		MEISNER OFFICE BUILDING (TO BE REMOVED)	1664.9'
44		STORAGE BUILDING	1691.7'
45		BIS AERO CENTER	1674.7'
46		FAA AIR TRAFFIC CONTROL TOWER	1733.4'
48		EXECUTIVE AIR TAXI	1676.3'
49		EXISTING PAY PARKING LOT EXIT PLAZA	1672.6'
50		FAA GLIDE SLOPE - RWY. 13	1700.7'
53		BIS AERO CENTER	
54		EXECUTIVE AIR FUEL FARM	1658.5'
56		BEYER HANGAR	
	60	SNOW REMOVAL EQUIPMENT (SRE) BUILDING	
	61	T-HANGARS	
	63	CORPORATE AVIATION AREA	
	64	ELECTRICAL VAULT AREA	
	65	CAR WASH FACILITY	
	67	RENTAL CAR STORAGE LOT	

* TO BE REMOVED OR RELOCATED

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SHEET CONTENTS

BUILDING AREA PLAN - NORTH

SHEET NO. 17 of 22

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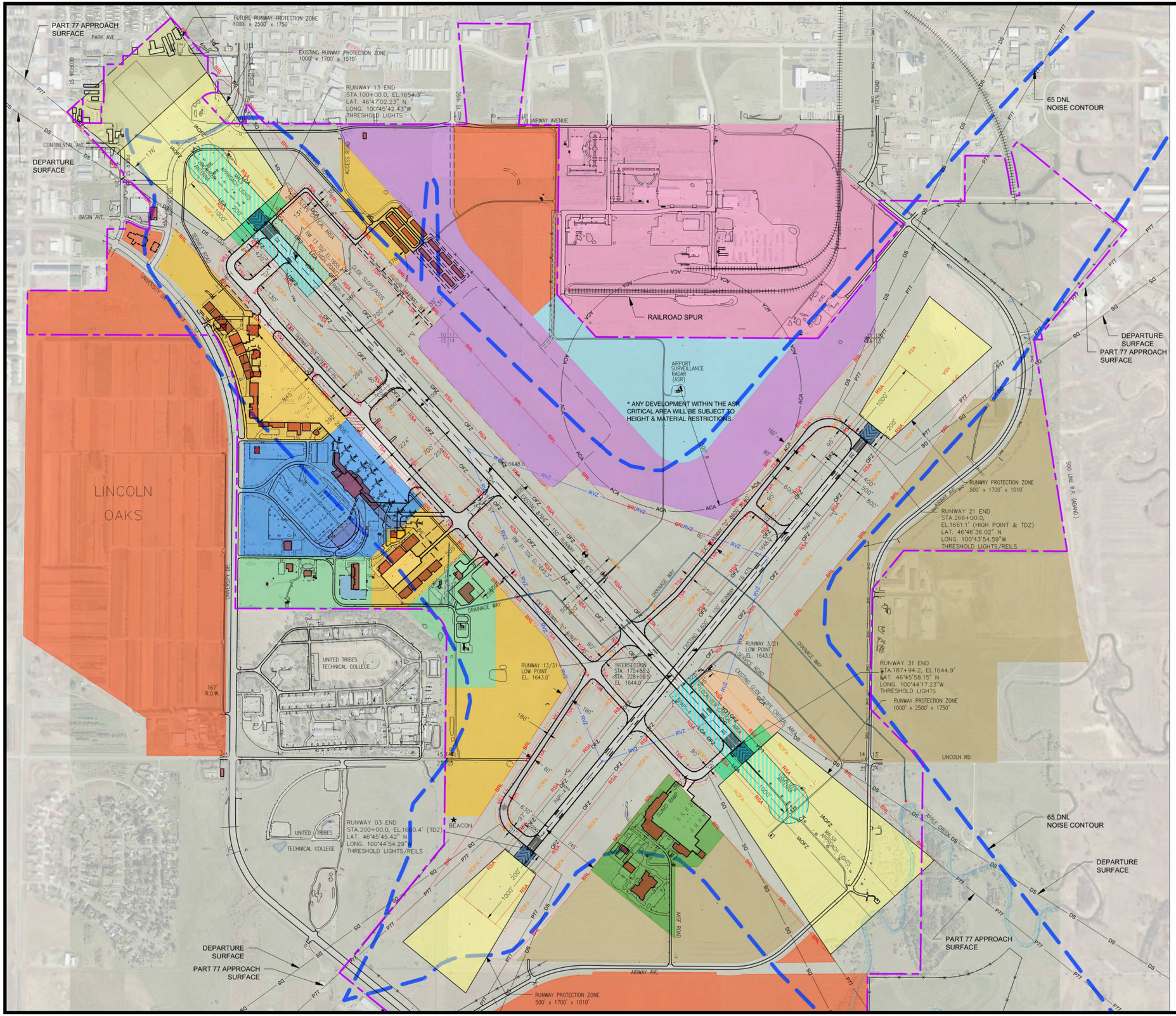
PART 77 APPROACH SURFACE
FUTURE RUNWAY PROTECTION ZONE 1000' x 2500' x 1750'
EXISTING RUNWAY PROTECTION ZONE 1000' x 1700' x 1510'
RUNWAY 13 END STA.100+00.0, EL.1654.3' LAT. 46°47'02.23" N LONG. 100°45'42.43"W THRESHOLD LIGHTS
65 DNL NOISE CONTOUR
DEPARTURE SURFACE
RAILROAD SPUR
AIRPORT SURVEILLANCE RADAR (ASR)
* ANY DEVELOPMENT WITHIN THE ASR CRITICAL AREA WILL BE SUBJECT TO HEIGHT & MATERIAL RESTRICTIONS.
DEPARTURE SURFACE PART 77 APPROACH SURFACE
RUNWAY PROTECTION ZONE 500' x 1700' x 1010'
RUNWAY 21 END STA.266+00.0, EL.1661.1' (HIGH POINT & TDZ) LAT. 46°46'36.02" N LONG. 100°43'54.59"W THRESHOLD LIGHTS/REILS
LINCOLN OAKS
UNITED TRIBES TECHNICAL COLLEGE
RUNWAY 13/31 LOW POINT EL. 1643.0'
INTERSECTION STA. 175+86.3 STA. 228+06.5 EL. 1644.0'
RUNWAY 31 END STA.187+94.2, EL.1644.9' LAT. 46°45'58.15" N LONG. 100°44'17.23"W THRESHOLD LIGHTS
RUNWAY PROTECTION ZONE 1000' x 2500' x 1750'
RUNWAY 03 END STA.200+00.0, EL.1650.4' (TDZ) LAT. 46°45'45.42" N LONG. 100°44'54.29" THRESHOLD LIGHTS/REILS
BEACON
65 DNL NOISE CONTOUR
DEPARTURE SURFACE
PART 77 APPROACH SURFACE
RUNWAY PROTECTION ZONE 500' x 1700' x 1010'
AIRWAY AVENUE
LINCOLN RD.
ACCESS ROAD
DRAINAGE WAY
UNIVERSITY DR.
CONTINENTAL AVE
BASIN AVE
PARK AVE
YEGEN ROAD
ASH ROAD
TRIPLE CREEK DR.
500' LINE R.R. (ABAN'D.)
6°0' E
±0°24'
Δ 0°6' W /year
AUG 2018
TRUE
0
600
1200

LAND USE LEGEND

	TERMINAL
	GENERAL AVIATION
	SUPPORT FACILITIES
	FUTURE AERONAUTICAL USE *
	AVIATION INDUSTRIAL
	COMMERCIAL DEVELOPMENT
	NPCC *
	NPCC SUPPORT *
	NATIONAL GUARD
	65 DNL NOISE CONTOUR

REVISIONS & NOTES

NO.	DESCRIPTION	DATE

NOTES:
* ANY DEVELOPMENT WITHIN THE ASR CRITICAL AREA WILL BE SUBJECT TO HEIGHT & MATERIAL RESTRICTIONS.

CITY OF BISMARCK ZONING ORDINANCE TITLE 10 CHAPTER 10-09

* SURROUNDING LAND USE SHOWN IN BISMARCK AIRPORT MASTER PLAN CHAPTER 1

DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT CONTROLLED PROPERTY LINE (FEE&EASEMENTS)		
AIRPORT BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
RUNWAY VISIBILITY ZONE	RVZ	
BUILDING RESTRICTION LINE	BRL	
OBSTACLE FREE ZONE	OFZ	
RUNWAY SAFETY AREA	RSA	
RUNWAY OBJECT FREE AREA	ROFA	
GLIDE SLOPE CRITICAL AREA (GCA)	GCA	
LOCALIZER CRICITAL AREA (LCA)	LCA	
AIRPORT SURVEILLANCE RADAR CRICITAL AREA (ACA)	ACA	
PRECISION OBSTACLE FREE ZONES (POFZ)		
FUEL STORAGE AREA		
AIRPORT BEACON		
LIGHTED WIND CONE & SEGMENTED CIRCLE		
WIND CONE		
PRECISION APPROACH PATH INDICATOR (PAPI)		
VISUAL APPROACH SLOPE INDICATOR (VASI)		
RUNWAY END IDENTIFIER LIGHTS (REIL)		
AIRPORT REFERENCE POINT (ARP)		

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SHEET CONTENTS

AIRPORT LAND USE PLAN

SHEET NO. 18 of 22

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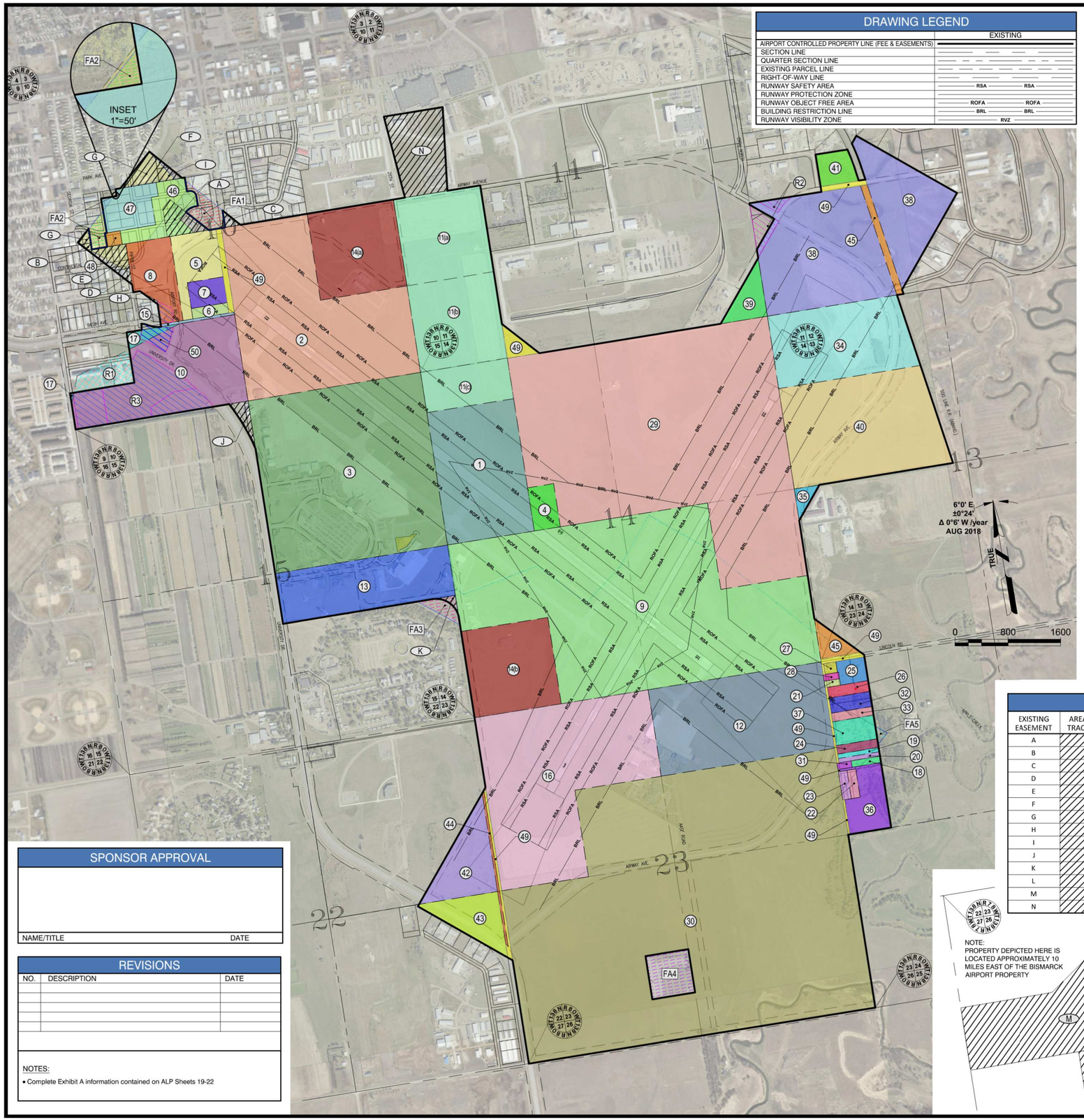


DRAWING LEGEND

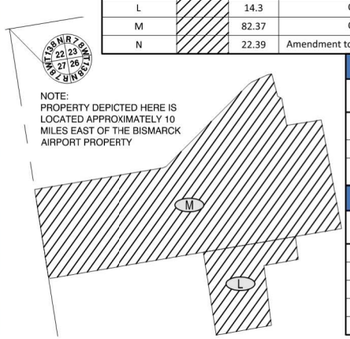
	EXISTING
AIRPORT CONTROLLED PROPERTY LINE (FEE & EASEMENTS)	
SECTION LINE	
QUARTER SECTION LINE	
EXISTING PARCEL LINE	
RIGHT-OF-WAY LINE	
RUNWAY SAFETY AREA	RSA RSA
RUNWAY PROTECTION ZONE	
RUNWAY OBJECT FREE AREA	ROFA ROFA
BUILDING RESTRICTION LINE	BRL BRL
RUNWAY VISIBILITY ZONE	RVZ

EXISTING PARCEL TABLE

EXISTING TRACT	AREA TRACT	AREA +/- (ACRES)	GRANTEE	DATE RECORDED	TYPE OF INSTRUMENT	FEDERAL PROJECT NUMBER
1		61.7	City of Bismarck	10/14/1940	WARRANTY DEED	9-32-035-801
2		120.4	City of Bismarck	10/22/1940	WARRANTY DEED	9-32-035-801
3		160.4	City of Bismarck	12/26/1947	QUIT CLAIM DEED	9-32-035-801
4		6.0	City of Bismarck	10/26/1948	QUIT CLAIM DEED	9-32-035-801
5		13.6	City of Bismarck	1/5/1955	WARRANTY DEED	9-32-035-504
6		2.0	City of Bismarck	10/7/1955	WARRANTY DEED	9-32-035-504
7		5.0	City of Bismarck	10/19/1955	CONDEMNATION	9-32-035-504
8		16.6	City of Bismarck	7/19/1956	WARRANTY DEED	9-32-035-0705
9		241.4	City of Bismarck	5/15/1959	CONDEMNATION	9-32-035-5907
10		60.3	City of Bismarck	8/10/1961	CONDEMNATION	9-32-035-C208
11(a)(b)(c)		99.3	City of Bismarck	6/2/1962	CONDEMNATION	9-32-035-6309
12		80.5	City of Bismarck	6/14/1962	CONDEMNATION	9-32-035-C208
13		46.8	City of Bismarck	10/10/1963	QUIT CLAIM DEED	QUIT CLAIM DEED (From U.S.A.)
14(a)(b)		40.1	City of Bismarck	1/8/1964	CONDEMNATION	9-32-035-C410
15		3.4	City of Bismarck	4/10/1964	WARRANTY DEED	Unknown
16		120.8	City of Bismarck	2/19/1968	CONDEMNATION	8-38-0003-01
17		4.0	City of Bismarck	3/17/1970	WARRANTY DEED	9-32-035-C208
18		1.0	City of Bismarck	6/21/1974	WARRANTY DEED	8-38-0003-04
19		0.9	City of Bismarck	7/10/1974	WARRANTY DEED	8-38-0003-04
20		0.9	City of Bismarck	7/19/1974	WARRANTY DEED	8-38-0003-04
21		0.5	City of Bismarck	8/26/1974	WARRANTY DEED	8-38-0003-04
22		1.3	City of Bismarck	8/26/1974	WARRANTY DEED	8-38-0003-04
23		1.3	City of Bismarck	8/27/1974	WARRANTY DEED	8-38-0003-04
24		1.9	City of Bismarck	9/9/1974	WARRANTY DEED	8-38-0003-04
25		3.6	City of Bismarck	9/9/1974	WARRANTY DEED	8-38-0003-04
26		2.4	City of Bismarck	9/9/1974	WARRANTY DEED	8-38-0003-04
27		0.7	City of Bismarck	10/9/1974	WARRANTY DEED	8-38-0003-04
28		0.5	City of Bismarck	10/9/1974	WARRANTY DEED	8-38-0003-04
29		275.7	City of Bismarck	1/2/1975	CONDEMNATION	8-38-0003-04
30		432.8	City of Bismarck	4/1/1975	CONDEMNATION	8-38-0003-04
31		0.5	City of Bismarck	4/19/1975	WARRANTY DEED	8-38-0003-04
32		3.3	City of Bismarck	9/30/1975	WARRANTY DEED	8-38-0003-04
33		1.9	City of Bismarck	10/21/1975	WARRANTY DEED	8-38-0003-04
34		52.7	City of Bismarck	2/11/1976	WARRANTY DEED	8-38-0003-04
35		2.1	City of Bismarck	4/27/1976	WARRANTY DEED	8-38-0003-04
36		12.0	City of Bismarck	8/24/1976	CONDEMNATION	8-38-0003-04
37		5.2	City of Bismarck	12/16/1976	CONDEMNATION	8-38-0003-04
38		36.0	City of Bismarck	1/21/1977	CONDEMNATION	8-38-0003-04
39		7.3	City of Bismarck	3/18/1977	QUIT CLAIM DEED	8-38-0003-04
40		81.0	City of Bismarck	4/13/1977	CONDEMNATION	8-38-0003-04
41		6.1	City of Bismarck	9/29/1981	WARRANTY DEED	6-38-0003-08
42		20.6	City of Bismarck	5/27/1982	QUIT CLAIM DEED	6-38-0003-08
43		14.6	City of Bismarck	5/27/1982	CONDEMNATION	6-38-0003-08
44		1.72	City of Bismarck	1/9/2007	QUIT CLAIM DEED	Unknown
45		8.3	City of Bismarck	1/2/2008	WARRANTY DEED	Unknown
46		12.6	City of Bismarck	12/7/2009	WARRANTY DEED	Unknown
47		10.8	City of Bismarck	12/7/2009	WARRANTY DEED	Unknown
48		1.1	City of Bismarck	6/21/2010	WARRANTY DEED	Unknown
49		16.2	City of Bismarck	3/1/2011	PLAT	No Grant
50		3.0	Bismarck Municipal Airport	5/12/2017	QUIT CLAIM DEED	No Grant

EXISTING AIRPORT EASEMENT TABLE

EXISTING EASEMENT	AREA TRACT	AREA (acres)	NATURE OF INTEREST	GRANTEE	DATE RECORDED	FEDERAL PROJECT NUMBER
A		4.66	Clear Zone Easement	City of Bismarck	9/9/1957	9-32-035-5706
B		0.26	Avigation and Hazard Easement	Bismarck Municipal Airport	5/13/1970	8-38-0003-01
C		0.70	Avigation and Hazard Easement	Bismarck Municipal Airport	6/22/1970	8-38-0003-01
D		0.70	Avigation and Hazard Easement	Bismarck Municipal Airport	9/11/1970	8-38-0003-01
E		3.50	Avigation and Hazard Easement	Bismarck Municipal Airport	9/11/1970	8-38-0003-01
F		0.39	Avigation and Hazard Easement	Bismarck Municipal Airport	10/20/1970	8-38-0003-01
G		4.14	Avigation and Hazard Easement	Bismarck Municipal Airport	10/20/1970	8-38-0003-01
H		0.12	Avigation and Hazard Easement	Bismarck Municipal Airport	10/20/1970	8-38-0003-01
I		1.22	Avigation and Hazard Easement	Bismarck Municipal Airport	4/26/1971	8-38-0003-01
J		2.16	Access Easement	City of Bismarck	6/8/2004	Unknown
K		0.61	Access Easement	City of Bismarck	7/12/2005	Unknown
L		14.3	Conservation Easement Agreement	City of Bismarck	11/17/2014	AIP 53
M		82.37	Conservation Easement Agreement	City of Bismarck	11/17/2014	AIP 53
N		22.39	Amendment to Easement Granted in Condemnation (Avigation)	City of Bismarck	10/27/2015	9-32-035-6309



NOTE:
PROPERTY DEPICTED HERE IS LOCATED APPROXIMATELY 10 MILES EAST OF THE BISMARCK AIRPORT PROPERTY

FAA RELEASE TABLE

TRACT	AREA TRACT	AREA +/- (ACRES)	DATE RECORDED	TYPE OF INSTRUMENT	FEDERAL PROJECT NUMBER
R1		7.49	7/25/1973	POST APPROVAL OF LAND EXCHANGE	9-32-035-C208
R2		4.78	9/5/2013	RELEASE FOR LAND SALE	8-38-0003-04
R3		33.3	9/11/2017	RELEASE FROM AERONAUTICAL	9-32-035-C208 9-32-035-705

ULTIMATE PARCEL TABLE

ULTIMATE TRACT	AREA TRACT	AREA +/- (ACRES)	TYPE OF INSTRUMENT	OWNER
FA1		4.6		
FA2		2.4		
FA3		3.0		
FA4		10.1		
FA5		0.5		

SPONSOR APPROVAL

NAME/TITLE DATE

REVISIONS

NO.	DESCRIPTION	DATE

NOTES:
- Complete Exhibit A information contained on ALP Sheets 19-22

Mead & Hunt

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Bismarck AIRPORT

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CITY OF BISMARCK
BISMARCK AIRPORT LAYOUT PLAN

2301 UNIVERSITY DR., BISMARCK, ND 58504

ISSUED

NOT FOR CONSTRUCTION

M&H PROJECT: 2716000-140293.01
AIP NO.: 3-38-003-055-2015
DATE: JAN 2019
DESIGNED BY: M&H
DRAWN BY: JWB
CHECKED BY: MRB
DO NOT SCALE DRAWINGS

SHEET CONTENTS
AIRPORT PROPERTY MAP - EXHIBIT 'A' PARCELS

SHEET NO: 19 of 22

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EXISTING PARCEL TABLE

PARCEL NUMBER	SECTION	ORIGINAL GRANT TRACT	2008 PROPERTY MAP TRACT	AREA +/-	AREA (PER DOC'S)	INTEREST	GRANTOR	GRANTEE	RECORD DOCUMENT INFORMATION	DATE RECORDED	TYPE OF INSTRUMENT	FEDERAL PROJECT NUMBER	NOTES
1	14	3	A	61.7	60.00	Fee	The Wachter Transfer Corporation	City of Bismarck	Book 231, Page 417	10/14/1940	WARRANTY DEED	9-32-035-801	South 2025' of the W1/2 of the NW1/4 Sec. 14. Judgement filed on 11/9/1948 in Book 274-Page 36 stating City of Bismarck is fee ower.
2	10	2	A	120.4	118.38	Fee	F. B. Struass and Marie Struass & Cora S. McLean	City of Bismarck	Book 237, Page 392	10/22/1940	WARRANTY DEED	9-32-035-801	S1/2 of the SE1/4 and the NW1/4 of the SE1/4 Sec. 10
3	15	1	A	160.4	160.00	Fee	United States of America	City of Bismarck	Book 268, Page 384	12/26/1947	QUIT CLAIM DEED	9-32-035-801	NE1/4 Sec. 15. Judgement filed on 11/9/1948 in Book 274-Page 36 stating City of Bismarck is fee ower.
4	14	4	A	6.0	6.00	Fee	Eugene Wachter and P. A. Wachter	City of Bismarck	Book 261, Page 346	10/26/1948	QUIT CLAIM DEED	9-32-035-801	West 3/5 of the SW1/4 of the SE1/4 of the NW 1/4 Sec. 14. Judgement filed on 11/9/1948 in Book 274-Page 36 stating City of Bismarck is fee ower.
5	10	5	B	13.6	13.64	Fee	Martin B. Monson and Olga B. Monson (1/2 Interest)- Frank E. Hedden and Helen L. Hedden (1/2 Interest)	City of Bismarck	Book 307, Pages 260 & 261	1/5/1955	WARRANTY DEED	9-32-035-504	Two - 1/2 interests in part of the N1/2 of the SW1/4 Sec. 10
6	10	7	B	2.0	2.00	Fee	John A. Hoffman and Blanche Hoffman	City of Bismarck	Book 307, Page 508	10/7/1955	WARRANTY DEED	9-32-035-504	Part of the N1/2 of the SW1/4 Sec. 10
7	10	6	B	5.0	5.00	Fee	Lawrence Schubert, Joseph Schubert and Katherine Schubert	City of Bismarck	Book 305, Page 579	10/19/1955	CONDEMNATION	9-32-035-504	Part of the N1/2 of the SW1/4 Sec. 10
8	10	8	C	16.6	20.00	Fee	Martin B. Monson and Olga B. Monson (1/2 Interest)- Frank E. Hedden and Helen L. Hedden (1/2 Interest)	City of Bismarck	Book 318, Pages 45 & 46	7/19/1956	WARRANTY DEED	9-32-035-0705	Two - 1/2 interests in part of the SW1/4 Sec. 10. 3.36 acres of the original 20.00 acre parcel was sold to Raymond W. Heinemeyer and Lloyd Gribble per document # 219340, recorded May 25, 1967
9	14		D & E	241.4	240.00	Fee	Helen Wachter	City of Bismarck	Book 335, Page 25	5/15/1959	CONDEMNATION	9-32-035-5907	N1/2 of the SW1/4; NW1/4 of the SE1/4; S1/2 of the SE 1/4; SE1/4 of the SW1/4, all in Sec. 14 (Grant document was not provided)
10	10		F	60.3	67.8	Fee	Wachter, ETAL	City of Bismarck	Book 349, Page 76	8/10/1961	CONDEMNATION	9-32-035-C208	Part of the S1/2 of the SW1/4 Sec. 10; 7.49 acres of the original 67.8 acres sold to Wachter, ETAL per document # 233111 recorded March 17, 1970
11(a)	11	15	G1	40	40	Fee	Wachter, ETAL	City of Bismarck	Book 349, Page 426	6/2/1962	CONDEMNATION	9-32-035-6309	NW1/4SW1/3 Sec. 11
11(b)	11	14	G1	40	40	Fee	Wachter, ETAL	City of Bismarck	Book 349, Page 426	6/2/1962	CONDEMNATION	9-32-035-6309	SW1/4SW1/3 Sec. 11
11(c)	14	13	G1	19.3	18.64	Fee	Wachter, ETAL	City of Bismarck	Book 349, Page 426	6/2/1962	CONDEMNATION	9-32-035-6309	W1/2 less the South 2025' of the NW1/4 Sec. 14
12	23	12	F	80.5	80.00	Fee	Oscar T. Solberg and Grace D. Solberg	City of Bismarck	Book 349, Page 451	6/14/1962	CONDEMNATION	9-32-035-C208	N1/2 of the NE1/4 Sec. 23
13	15	16	H	46.8	46.70	Fee	United States of America	City of Bismarck	Book 359, Page 582	10/10/1963	QUIT CLAIM DEED	QUIT CLAIM DEED (From U.S.A.)	North 770' of the SE1/4 Sec. 15
14(a)	10	17	I	40.1	40	Fee	Square Butte, a Partnership	City of Bismarck	Book 361, Page 124	1/8/1964	CONDEMNATION	9-32-035-C410	SW1/4 of the SW1/4 Sec. 14
14(b)	14	18	I	40.2	40	Fee	Square Butte, a Partnership	City of Bismarck	Book 361, Page 124	1/8/1964	CONDEMNATION	9-32-035-C410	NE1/4 of the SE1/4 Sec. 10
15	10			3.4	3.36	Fee	Raymond W. Heinemeyer and Lloyd Gribble	City of Bismarck	Book 365, Page 24	4/10/1964	WARRANTY DEED	No Grant	Part of the N1/2 of the SW1/4 Sec. 10
16	23	19	K	120.8	120.00	Fee	Oscar T. Solberg	City of Bismarck	Doc. No. 222994	2/19/1968	CONDEMNATION	8-38-0003-01	NW1/4 of the NW1/4; NE1/4 of the NW1/4; and SW1/4 of the NW1/4, all in Sec. 23
17	10	4, 5 & 7	L & F	4.0	3.96	Fee	Trustees of Wachter Real Estate Trust	City of Bismarck	Doc. No. 233111	3/17/1970	WARRANTY DEED	9-32-035-C208	Part of the SW1/4 Sec. 10 (3 small parcels)
18	24	H	M	1.0	1.00	Fee	Matt R. Schafer and Diane J. Schafer	City of Bismarck	Doc. No. 256305	6/21/1974	WARRANTY DEED	8-38-0003-04	Part of Lot 12, Lincoln Outlots
19	24	H	M	0.9	0.95	Fee	N. A. Nissen and Ruth Nissen	City of Bismarck	Doc. No. 256680	7/10/1974	WARRANTY DEED	8-38-0003-04	N1/2 of Lot 11, Lincoln Outlots
20	24	H	M	0.9	0.95	Fee	W. H. Schoon and Irene A. Schoon	City of Bismarck	Doc. No. 256900	7/19/1974	WARRANTY DEED	8-38-0003-04	S1/2 of Lot 11, Lincoln Outlots
21	24	H	M	0.5	0.46	Fee	Alice Heiser	City of Bismarck	Doc. No. 257670	8/26/1974	WARRANTY DEED	8-38-0003-04	South 99' of Lot 2 & part of Lot 3, Lincoln Outlots
22	24	H	M	1.3	1.24	Fee	Lawrence L. Tice and Eleanor M. Tice	City of Bismarck	Doc. No. 257669	8/26/1974	WARRANTY DEED	8-38-0003-04	Lot 15 and the E 1/2 of Lot 14, Lincoln Outlots, and a 33' strip lying north of and adjacent to said tract
23	24	H	M	1.3	1.01	Fee	Paul E. Kuetemeyer and Kathleen L. Kuetemeyer	City of Bismarck	Doc. No. 257700	8/27/1974	WARRANTY DEED	8-38-0003-04	Lot 13 and the W 1/2 of Lot 14 Lincoln Outlots, and a 33' strip lying north of and adjacent to said tract
24	24	H	M	1.9	1.90	Fee	Frank Mickelson, Ray Mickelson and Mabel Mickelson	City of Bismarck	Doc. No. 257936	9/9/1974	WARRANTY DEED	8-38-0003-04	Lot 10, Lincoln Outlots
25	24	H	M	3.6		Fee	Charles J. Holkup and Pauline Holkup	City of Bismarck	Doc. No. 257938	9/9/1974	WARRANTY DEED	8-38-0003-04	Lot 4 and part of Lot 3, Lincoln Outlots
26	24	H	M	2.4	2.37	Fee	Charles J. Holkup and Pauline Holkup	City of Bismarck	Doc. No. 257937	9/9/1974	WARRANTY DEED	8-38-0003-04	Lot 5, Lincoln Outlots
27	24	H	M	0.7	0.71	Fee	Engelbert Ternes and Ramona Ternes	City of Bismarck	Doc. No. 258552	10/9/1974	WARRANTY DEED	8-38-0003-04	Lot 1, Lincoln Outlots
28	24	H	M	0.5	0.46	Fee	Engelbert Ternes and Ramona Ternes	City of Bismarck	Doc. No. 258549	10/9/1974	WARRANTY DEED	8-38-0003-04	Part of Lots 2 & 3, Lincoln Outlots
29	14	F	M	275.7	274.00	Fee	Wachter, ETAL	City of Bismarck	Doc. No. 259995	1/2/1975	CONDEMNATION	8-38-0003-04	NE1/4 of the SE1/4; NE1/4; and the E1/2 of the NW1/4, LESS the West 3/5 of the SW1/4 of the SE1/4 of the NW1/4, all in Sec. 14
30	23	G	M	432.8	430.00	Fee	Dennis Theodore Solberg and John Daly Solberg	City of Bismarck	Doc. No. 261105	4/1/1975	CONDEMNATION	8-38-0003-04	S1/2 of the NE1/4; SE1/4 of the NW1/4; SE1/4; and the SW1/4 LESS the NE1/4 of the SE1/4 of the SW1/4, all in Sec. 23
31	24	H	M	0.5	.425	Fee	Donald W. Cook and J. Virginia Cook	City of Bismarck	Doc. No. 260955	4/19/1975	WARRANTY DEED	8-38-0003-04	Part of Lot 12, Lincoln Outlots
32	24	H	M	3.3	3.32	Fee	William H. Bement	City of Bismarck	Doc. No. 265008	9/30/1975	WARRANTY DEED	8-38-0003-04	Lots 6 and 7, Lincoln Outlots
33	24	H	M	1.9	1.90	Fee	R. D. Bowman	City of Bismarck	Doc. No. 265541	10/21/1975	WARRANTY DEED	8-38-0003-04	Lot 8, Lincoln Outlots
34	13	B	M	52.7		Fee	John Kenneth Bauman and Beth H. Bauman	City of Bismarck	Doc. No. 267692	2/11/1976	WARRANTY DEED	8-38-0003-04	Part of the W1/2 Sec.13
35	13	D	M	2.1	2.13	Fee	Christ P. Yegen and Lydia Yegen	City of Bismarck	Doc. No. 278121	4/27/1976	WARRANTY DEED	8-38-0003-04	Part of the NW1/4 of the SW1/4 of Sec. 13 (triangle tract)
36	24	H	M	12.0	11.63	Fee	Wayne L. Lindteigen and Shyrll G. Lindteigen	City of Bismarck	Doc. No. 272123	8/24/1976	CONDEMNATION	8-38-0003-04	Lot 16 and the South 33' of Lot 12, Lincoln Outlots
37	24	H	M	5.2	5.22	Fee	Marie Kidder aka Marie K. Larsen	City of Bismarck	Doc. No. 274869	12/16/1976	CONDEMNATION	8-38-0003-04	Lot 9, Lincoln Outlots
38	12	A	M	36.0	35.96 (TRACT 1) 72.72 (TRACT 3)	Fee	Patterson Land Company	City of Bismarck	Doc. No. 275646	1/21/1977	CONDEMNATION	8-38-0003-04	Two tracts in the S1/2 Sec. 12. Three separate tracts were sold (Auditor's Lots A, B, & C of Lot 2 as recorded as Doc. #'s 798842, 814514, & 862044. Federal project number does not include the property east of the railroad.
39	11	E	M	7.3	7.31	Fee	State of North Dakota	City of Bismarck	Doc. No. 277015	3/18/1977	QUIT CLAIM DEED	8-38-0003-04	SE1/4 of the SE1/4 Sec. 11 (triangle tract)
40	13	C	M	81.0	81.16	Fee	Harley B. Thom and Helen R. Thom and Dakota National Bank of Bismarck	City of Bismarck	Doc. No. 277693	4/13/1977	CONDEMNATION	8-38-0003-04	Part of the W1/2 Sec. 13
41	12	2	M	6.1		Fee	Sandra K. Eggebraten and Dean Eggebratem	City of Bismarck	Doc. No. 324997	9/29/1981	WARRANTY DEED	6-38-0003-08	South 95' Lot 4 except the West 1040' thereof, and Lot 5 except the West 1040' thereof, all inf Duemeland Subdivision
42	22	3	N	20.6	20.64	Fee	Rhea McDonald; Catheriine Layer and Wesley Layer; Mary Ann Brown; Betty Leuwer; James D. McDonald; Dan J. McDonald and Leone M. McDonald	City of Bismarck	Doc. No. 329585	5/27/1982	QUIT CLAIM DEED	6-38-0003-08	Part of the E1/2 of the NE1/4 Sec. 22
43	22	3	N	14.6	14.58	Fee	Dan J. McDonald and Leona M. McDonald	City of Bismarck	Doc. No. 329586	5/27/1982	CONDEMNATION	6-38-0003-08	Part of the E1/2 of the SE1/4 Sec. 22
44	22		N		1.72		North Dakota Department of Transportation	City of Bismarck	Doc. No. 666365	1/9/2007	QUIT CLAIM DEED	Unknown	Part of the E1/2 Sec. 22 per right-of-way plat
45	13		V & W	8.3	4.97+/-	Fee	Lincoln Land Development, LLP	City of Bismarck	Doc. No. 683529	1/2/2008	WARRANTY DEED	Unknown	Triangle tract in the SW1/4 of the SW1/4 Sec. 13 & a strip of land 100 ft wide in Sec 12
46	10		D1 & K1	12.6		Fee	Steve & Karen McCormick	City of Bismarck	Doc. No. 718496	12/7/2009	WARRANTY DEED	Unknown	Lots 4, 5, 6, & 7 of Block3; Lots 3, 4, 5, 6, 7, 8, 9, 10, & 11 of Block 4; Lots 1, 2, 3, 4, 5, & 6 of Block 5; Lots 8 & 9 of Block 6, all in Shamrock Industrial Park
47	10			10.8		Fee	Cathedral of Holy Spirit	City of Bismarck	Doc. No. 718497	12/7/2009	WARRANTY DEED	Unknown	Lots 1, 2, 3, 4, 6, 7, 8, 9, & 10 of Block2; Lots 1, 2, & 3 of Block 3; Lots 1, 2, 12, & 13 of Block 4; all in Shamrock Industrial Park
48	10		K1	1.1		Fee	Bismarck Hockey Boosters, Inc.	City of Bismarck	Doc. No. 727387	6/21/2010	WARRANTY DEED	Unknown	Lots 6 & 7 of Block 6, Shamrock Industrial Park
49				16.2			City of Bismarck/ ND Association of Soil Conservation Districts	Public	Doc. No. 741481	3/1/2011	PLAT	No Grant	Bismarck Airport Addition
50	10			3.0		Fee	City of Bismarck	Bismarck Municipal Airport	Doc. No. 856710	5/12/2017	QUIT CLAIM DEED	No Grant	Lot 1 of Block 8, Bismarck Aiport Addition

EXISTING AIRPORT EASEMENT TABLE

EXISTING EASEMENT	AREA (acres)	ORIGINAL GRANT TRACT ★	NATURE OF INTEREST	GRANTEE	GRANTOR	DATE RECORDED	RECORD DOCUMENT INFORMATION	FEDERAL PROJECT NUMBER	NOTES
A	4.66	9	Clear Zone Easement	City of Bismarck	Northern Improvement Company	9/9/1957	Book 319, Page 494	9-32-035-5706	Part of SE1/4 NW1/4 Sec. 10-T138-R80
B	0.26	A	Avigation and Hazard Easement	Bismarck Municipal Airport	David W. Wahl and Sharon J. Wahl	5/13/1970	Doc. No. 233566	8-38-0003-01	Part of the SW1/4SW1/4NW1/4 Sec. 10
C	0.70	F	Avigation and Hazard Easement	Bismarck Municipal Airport	Supercrete Industries, Inc.	6/22/1970	Doc. No. 233976	8-38-0003-01	Part of the SW1/4SW1/4NE1/4 Sec. 10
D	0.70	H	Avigation and Hazard Easement	Bismarck Municipal Airport	Henry Stip and Beverly Stip	9/11/1970	Doc. No. 234865	8-38-0003-01	Part of the N1/2NW1/4SW1/4 Sec. 10
E	3.50	G	Avigation and Hazard Easement	Bismarck Municipal Airport	Northwest Rendering Company	9/11/1970	Doc. No. 234866	8-38-0003-01	Part of the N1/2NW1/4SW1/4 Sec. 10
F	0.39	K	Avigation and Hazard Easement	Bismarck Municipal Airport	Raymond W. Heinemeyer	10/20/1970	Doc. No. 235302	8-38-0003-01	Part of the S1/2NW1/4 Sec. 10
G	4.14	B&J	Avigation and Hazard Easement	Bismarck Municipal Airport	The Milton Rue Company	10/20/1970	Doc. No. 235303	8-38-0003-01	Part of the S1/2NW1/4 Sec. 10
H	0.12	I	Avigation and Hazard Easement	Bismarck Municipal Airport	Raymond W. Heinemeyer and Lloyd S. Gribble	10/20/1970	Doc. No. 235304	8-38-0003-01	Part of the Aero-Commercial Subdivision
I	1.22	E	Avigation and Hazard Easement	Bismarck Municipal Airport	Jean Porter and Louis C. Porter	4/26/1971	Doc. No. 237390	8-38-0003-01	Part of the S1/2NW1/4 Sec. 10
J	2.16		Access Easement	City of Bismarck	North Dakota Association of Soil Conservation Districts	6/8/2004	Doc. No. 620265	Unknown	Part of the NE1/4 NW1/4 Sec. 15-T138-R80
K	0.61		Access Easement	City of Bismarck	United Tribes Technical College Bismarck	7/12/2005		Unknown	City of Bismarck Memorandum
L	14.3		Conservation Easement Agreement	City of Bismarck	Douglas Goehring	11/17/2014	Doc. No. 815559	AIP 53	Pt. of the SW1/4 Sec. 26, T138, R78
M	82.37		Conservation Easement Agreement	City of Bismarck	Robert E. Hieb & Debra Ann Hieb	11/17/2014	Doc. No. 815560	AIP 53	Pt. of the N1/2 Sec. 26, T138, R78
N	22.39		Amendment to Easement Granted in Condemnation (Avigation)	City of Bismarck	Watcher, ETAL	10/27/2015	Doc. No. 832156	9-32-035-6309	SW1/4 NW1/4 Sec. 11

★ Federal Grant 8-38-0003-01 References "Tract C". No information was provided that identifies the location of this tract.

Mead & Hunt

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Bismarck AIRPORT

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CITY OF BISMARCK
BISMARCK AIRPORT LAYOUT PLAN

2301 UNIVERSITY DR., BISMARCK, ND 58504

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SHEET CONTENTS

AIRPORT PROPERTY MAP - EXHIBIT 'A' PARCEL TABLES

SHEET NO. 20 of 22

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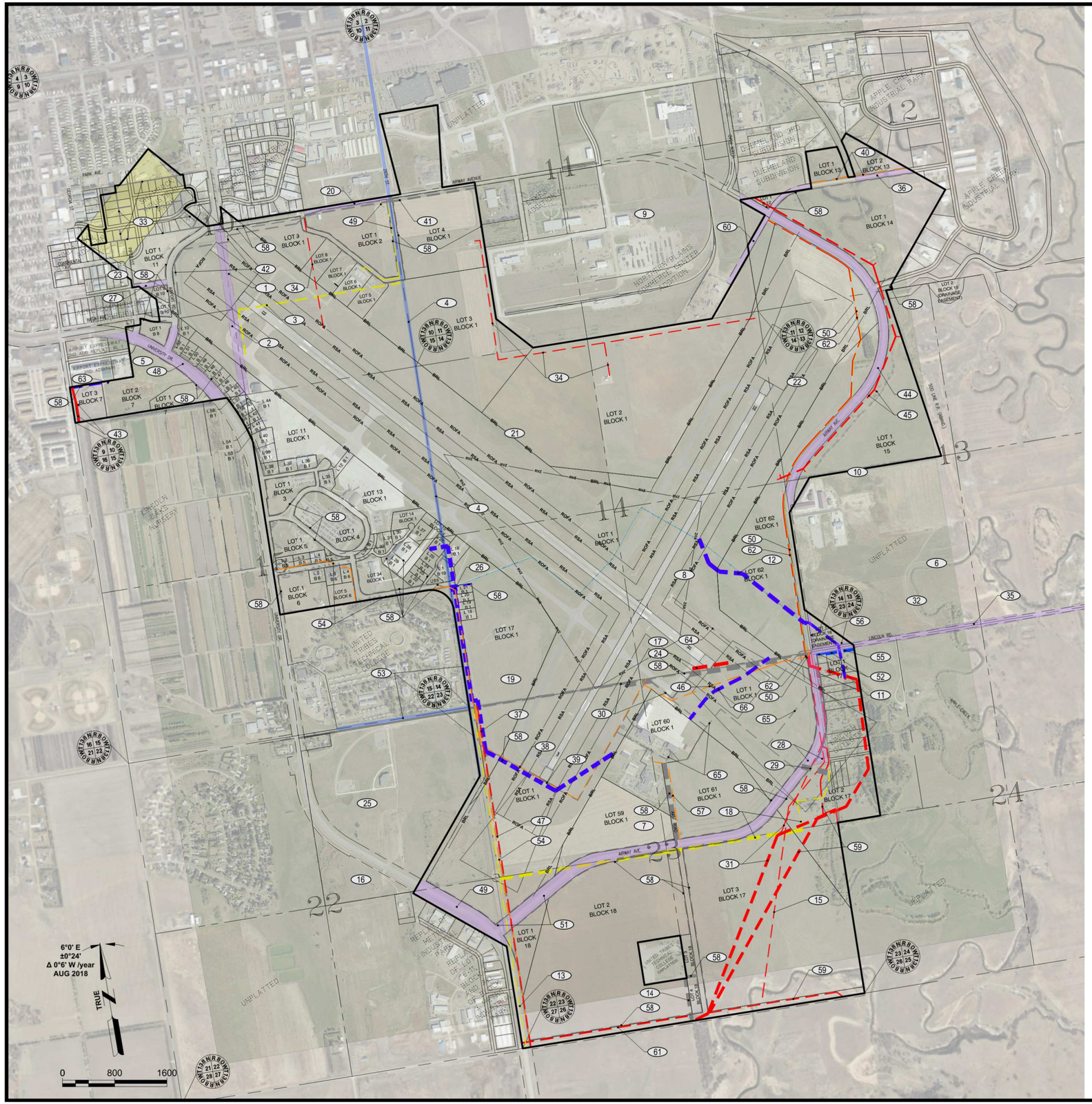

EXISTING EASEMENT TABLE

EXISTING EASEMENT	NATURE OF INTEREST	GRANTEE	DATE RECORDED
1	Right-of-Way Plat	Public	2/27/1935
2	Right-of-Way Plat	Public	5/7/1935
3	Easement Agreement	City of Bismarck	5/13/1936
4	Section Line Road Closure	Public	7/19/1940
5	Transmission Line Right-of-Way Agreement	The Dakota Public Service Company	5/5/1941
6	Easement	The Dakota Public Service Company	10/19/1945
7	Right-of-Way Easement	Capital Electric Cooperative	4/9/1954
8	Right-of-Way Easement	Capital Electric Cooperative, Inc.	4/9/1954
9	Right-of-Way Easement	Capital Elecrtric Cooperative	4/9/1954
10	Right-of-Way Easement	Capital Elecrtric Cooperative	4/9/1954
11	Drainage Ditch Easement	City of Bismarck	2/23/1950
12	Drainage Ditch Easement	City of Bismarck	2/27/1950
13	Pipeline and Telephone Line Easement	Montana-Dakota Utilities Co.	5/13/1958
14	Easement	United States of America	8/15/1958
15	Right-of-Way Easement	Capital Electric Cooperative	3/25/1959
16	Right-of-Way Easement	Capital Elecrtric Cooperative	3/23/1961
17	Right-of-Way Permit	Northwestern Bell Telephone Company	10/20/1961
18	Right-of-Way Easement	Montana-Dakota Utilities Co.	2/23/1962
19	Right-of-Way Permit	Northwestern Bell Telephone Company	6/215/1962
20	Easement	City of Bismarck	5/13/1963
21	Right-of-Way Easement	Capital Electric Cooperative, Inc.	3/4/1965
22	Right-of-Way Easement	Capital Elecrtric Cooperative	3/1/1966
23	Right-of-Way Easement	Capital Elecrtric Cooperative	3/1/1966
24	Electric Line Easement	Montana-Dakota Utilities Co.	10/23/1967
25	Right-of-Way Easement	Northwestern Bell Telephone Company	9/9/1970
26	Easement	United Tribes of ND Development Corp	2/25/1974
27	Right-of-Way Plat	Public	12/23/1974
28	Easement	Public	1/24/1978
29	Easement	Public	1/24/1978
30	Easement	Montana-Dakota Utilities Co. and Northwestern Bell Telephone Company	12/20/1978
31	Easement	Capital Electric Cooperative	12/20/1978
32	Easement	Northwestern Bell Telephone Company	4/2/1981
33	Plat	Public/City of Bismarck	4/27/1981
34	Underground Electrical Easement	Capital Elecrtric Cooperative	1/22/1982
35	Right-of-Way Easement	Burleigh County	6/20/1986
36	QCD	Public	1/2/1987
37	Right-of-Way Easement	Capital Electric Cooperative	7/23/1986
38	Easement	Northwestern Bell Telehone Company	11/18/1986
39	Easement	Mcntana Dakota Utilities	11/20/1986
40	Easement	US West Communication	10/10/1995
41	Underground Easement	US West Communications, Inc.; Montana-Dakota Utilities Co. and Sioux Fals Cable Television	10/27/1995
42	Easement	US West Communications, Inc.; Montana-Dakota Utilities Co. and Sioux Fals Cable Television	4/30/1996
43	Easement Agreement	Capital Elecrtric Cooperative	1/28/1997
44	Dedication	Public	5/28/1997
45	Easement Agreement	Capital Elecrtric Cooperative	12/29/1997
46	Easement	U. S. West Communications, Inc.	8/17/1999
47	Easement	University of Mary	5/17/2002
48	Easement	ND Department of Transportation	11/20/2002
49	Easement	Montana-Dakota Utilities Company	4/3/2003
50	Easement	Montana-Dakota Utilities Company	4/3/2003
51	Right-of-Way Plat	Public	6/6/2003
52	Easement Agreement	City of Linclon	8/31/2004
53	Section Line Road Closure	Public	8/8/2005
54	Easement Agreement	Mcntana Dakota Utilities	5/27/2006
55	Right-of-Way Easement	City of Bismarck	3/1/2011
56	Right-of-Way Easement	City of Bismarck	3/1/2011
57	Easement Agreement	Montana Dakota Utilities Co.	1/21/2011
58	Plat	Public	3/1/2011
59	Easement Agreement	Capital Elecrtric Cooperative	8/3/2011
60	Access Easement	Northern Metals, LLC	6/13/2013
61	Right-of-Way Easement	Capital Electric Cooperative	12/4/2013
62	Easement Agreement	Montana Dakota Utilities	3/10/2014
63	Easement Agreement	Paramount Builders, Inc.	6/2/2014
64	Easement Agreement	Montana Dakota Utilities & Quest Corporation	8/2/2018
65	Easement Agreement	Montana Dakota Utilities & Quest Corporation	8/2/2018
66	Easement Agreement	State of North Dakota	2/20/2018

DRAWING LEGEND

	EXISTING
ACCESS EASEMENT	
ROAD RIGHT-OF-WAY	
ELECTRICAL EASEMENT	
TELEPHONE EASEMENT	
GAS EASEMENT	
DRAINAGE EASEMENT	
GENERAL UTILITY EASEMENT	
LOT LINE	
RIGHT-OF-WAY LINE	
AIRPORT CONTROLLED PROPERTY LINE (FEE&EASEMENTS)	
RUNWAY SAFETY AREA	RSA RSA
RUNWAY PROTECTION ZONE	
RUNWAY OBJECT FREE AREA	ROFA ROFA
BUILDING RESTRICTION LINE	BRL BRL
RUNWAY VISIBILITY ZONE	RVZ

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CITY OF BISMARCK
BISMARCK AIRPORT LAYOUT PLAN

2301 UNIVERSITY DR., BISMARCK, ND 58504

ISSUED

NOT FOR CONSTRUCTION

M&H PROJECT:	2716000-140293.01
AIP NO.:	3-38-003-055-2015
DATE:	JAN 2019
DESIGNED BY:	M&H
DRAWN BY:	JWB
CHECKED BY:	MRB

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SHEET CONTENTS

AIRPORT PROPERTY MAP - EXHIBIT 'A' EASEMENTS

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EXISTING EASEMENT TABLE

EXISTING EASEMENT	NATURE OF INTEREST	GRANTEE	GRANTOR	DATE RECORDED	RECORD DOCUMENT INFORMATION	Notes
1	Right-of-Way Plat	Public	North Dakota Department of Transportation	2/27/1935	Book 225, Page 30	Right-of-way plat for a 60' wide strip across the west side of the SE1/4 Sec. 10
2	Right-of-Way Plat	Public	North Dakota Department of Transportation	5/7/1935	Book 225, Page 31	Right-of-way plat for a 60' wide strip across the west side of the SE1/4 Sec. 10
3	Agreement	City of Bismarck	Montana-Dakota Utilities Company	5/13/1936	Book 228, Page 123	Agreement for a gas line to be placed in a 20' wide strip across the S1/2 of the SE1/4 Sec. 10
4	Resolution	Public	Burleigh County	7/19/1940	Book 274, Page 280	Resolution to close section line roads between Sec. 10 & 11 and between Sec. 14 & 15
5	Agreement	The Dakota Public Service Company	Wachters Transfer Corp & Wachters Incorporated	5/5/1941	Book 237, Page 501	Easement for a transmission line across a strip no more than 20' wide across the S1/2 of the SW1/4 Sec. 10
6	Easement	The Dakota Public Service Company	C.D. Yegen	10/19/1945	Book 259, Page 63	Easement for transmission line along the south side of S1/2 Sec. 13. No width defined in abstract.
7	Easement	Capital Electric Cooperative	James J. Lindley	4/9/1954	Book 308, Page 13	Blanket right-of-way easement for a transmission line over all of Sec. 23. No width defined in abstract.
8	Easement	Capital Electric Cooperative, Inc.	Paul Wachter and Eugene Wachter	4/9/1954	Book 308, Page 4	Blanket right-of-way easement for a transmission line over the SE1/4 Sec. 14. No width defined in abstract.
9	Easement	Capital Elecrtric Cooperative	Board of Administration, State of North Dakota	4/9/1954	Book 308, Page 2	Blanket right-of-way easement for a transmission line over the SE1/4 Sec. 11. No width defined in abstract.
10	Easement	Capital Elecrtric Cooperative	Wm. Schantz / CP Yegen	4/9/1954	Book 308, Page 3	Blanket transmission or distribution line easement across the NW1/4 Sec. 13 and SW1/4 Sec. 13. No width defined in abstract.
11	Easement	City of Bismarck	Randall Ross Boyd and Charlette L. Boyd	2/23/1950	Book 274, Page 504	40' Easement for a drainage ditch over the NW1/4 Sec. 24
12	Easement	City of Bismarck	Eugene Wachter	2/27/1950	Book 274, Page 505	60' Easement for a drainage ditch over the S1/2 Sec. 14
13	Easement	Montana-Dakota Utilities Co.	Oscar T. Solberg and Grace D. Sloberg	5/13/1958	Book 326, Page 162	10' Easement for a gas pipe line over the W1/2 of Sec. 23
14	Easement	United States of America	Oscar T. Solberg and Grace D. Sloberg	8/15/1958	Book 326, Page 274	50' Easement for utility lines and access road across the East 50' of the SE1/4 of the SE1/4 of the SW1/4 of Sec. 23
15	Easement	Capital Electric Cooperative	Oscar T. Solberg	3/25/1959	Book 308, Page 81	Blanket right-of-way easement for a transmission line across Sec. 23. No width defined in abstract.
16	Easement	Capital Elecrtric Cooperative	Dan J. McDonald	3/23/1961	Book 308, Page 106	Blanket right-of-way easement for a transmission line across Sec. 22. No width defined in abstract.
17	Permit	Northwestern Bell Telephone Company	City of Bismrack	10/20/1961	Book 349, Page 161	Permit for the perpetual right to construct telephone lines located approx. 42' north of the south line of the SE1/4 of the SW1/4 of the S1/2 of the SE1/4 Sec. ?- No width or Sec. # defined in abstract.
18	Easement	Montana-Dakota Utilities Co.	Oscar T. Solberg and Grace D. Sloberg	2/23/1962	Book 328, Page 372	50' and 14' easement for gas pipeline over part of Sec. 23
19	Permit	Northwestern Bell Telephone Company	Helen Wachter	6/215/1962	Book 349, Page 454	Permit for the perpetual right to construct telephone lines located approx. 42' north of the south line of the SW1/4 of the SW1/4 of Sec. 14- No width defined in abstract.
20	Easement	City of Bismarck	Wachter Real Estate Trust	5/13/1963	Book 359, Page 311	66' Easement for roadway across the North 66' of the NE1/4 of the SE1/4 Sec. 10
21	Easement	Capital Electric Cooperative, Inc.	Wachter Ranch	3/4/1965	Book 308, Page 178	Blanket easement for transmission line over the NW1/4 Sec. 14. No width defined in abstract.
22	Easement	Capital Elecrtric Cooperative	Harley B. Thom	3/1/1966	Doc. No. 213810	Blanket easement for transmission line over the NW1/4 Sec. 13. No width defined in abstract.
23	Easement	Capital Elecrtric Cooperative	Northern Improvement Company	3/1/1966	Doc. No. 213809	Blanket easement for transmission line over the N1/2 of the SW1/4 Sec. 10. No width defined in abstract.
24	Easement	Montana-Dakota Utilities Co.	City of Bismarck	10/23/1967	Doc. No. 221331 & 221493	12' easement for underground electric line in the S1/2 of the SE1/4 of Sec. 14
25	Easement	Northwestern Bell Telephone Company	Dan J. McDonald	9/9/1970	Doc. No. 234829	Blanket easement across the N1/2 N1/2 Sec. 22. No width defined in abstract.
26	Easement	United Tribes of ND Development Corp	City of Bismarck	2/25/1974	Doc. No. 253804	100' x 100' easement for storm water system in the SW1/4 of Sec. 14
27	Right-of-Way Plat	Public	City of Bismarck	12/23/1974	Doc. No. 259922	Grant for highway purposes over the N1/2 of the SW1/4 Sec. 10
28	Easement	Public	City of Bismarck	1/24/1978	Doc. No. 287748	Easement for street and highway purposes over the N1/2 & NE1/4 Sec. 23
29	Easement	Public	City of Bismarck	1/24/1978	Doc. No. 287749	80' easement for water and sewer purposes over the NE1/4 of Sec. 23
30	Easement	Montana-Dakota Utilities Co. and Northwestern Bell Telephone Company	City of Bismarck	12/20/1978	Doc. No. 299399	Multiple easments with multiple widths for underground stilities over part of Sec. 23
31	Easement	Capital Electric Cooperative	City of Bismarck	12/20/1978	Doc. No. 299400	40' easement for transmission line over the E1/2 Sec. 23
32	Easement	Northwestern Bell Telephone Company	Chris Yegen	4/2/1981	Doc. No. 320698	10' blanket easement for tehlphone line in part of the S1/2 of the SW1/4 Sec. 13
33	Plat	Public/City of Bismarck	Lazy S Ranch/ McCormick Propoerties/ City of Bismarck	4/27/1981	Doc. No. 321299	Plat of Shamrock Industrial Park located in the W1/2 Sec. 10
34	Easement	Capital Elecrtric Cooperative	City of Bismarck	1/22/1982	Doc. No. 327336	Multiple 10' wide easements in Sec. 10, 11 & 14
35	Right-of-Way Plat	Burleigh County	Public	6/20/1986	Doc. No. 370663	Right-of-Way plat over the SW1/4 Sec. 13
36	Quit Claim Deed	Public	City of Bismarck	1/2/1987	Doc. No. 376844	Quit Claim Deed for public right-of-way for part of the S1/2 Sec. 12
37	Easement	Capital Electric Cooperative	City of Bismarck	7/23/1986	Doc. No. 371696	14' wide easement for transmission line over part of Sec. 23
38	Easement	Northwestern Bell Telehone Company	City of Bismarck	11/18/1986	Doc. No. 375392	10' wide easement for underground utility over part of the N1/2 Sec. 23
39	Easement	Montana Dakota Utilities	City of Bismarck	11/20/1986	Doc. No. 375446	10' wide easement for underground utility over part of the N1/2 Sec. 23
40	Easement	US West Communication	City of Bismarck	10/10/1995	Doc. No. 477381	10' wide easement for telecommunicaiton facilities in part of Sec. 12 (AMENDED)
41	Easement	US West Communications, Inc.; Montana-Dakota Utilities Co. and Sioux Fals Cable Television	City of Bismarck	10/27/1995	Doc. No. 478036	25' and a 40' wide easement over the part of the NW1/4 of the SW1/4 Sec. 11
42	Easement Agreement	US West Communications, Inc.; Montana-Dakota Utilities Co. and Sioux Fals Cable Television	City of Bismarck	4/30/1996	Doc. No. 483929	Easement agreement for a 15' wide strip to construct utilities in part of the N1/2 of the SE1/4 and the NE1/4 of the SW1/4 Sec. 10
43	Easement Agreement	Capital Elecrtric Cooperative	City of Bismarck	1/28/1997	Doc. No. 494074	30' easement for electrical facilities over part of the SW1/4 Sec. 10
44	Dedication	Public	City of Bismarck	5/28/1997	Doc. No. 497870	150' wide dedication to the public for public roadway over the W1/2 Sec. 13 and the SW1/4 Sec. 12
45	Easement Agreement	Capital Elecrtric Cooperative	City of Bismarck	12/29/1997	Unknown	20' easement agreement for electrical facilities over part the the NE1/4 Sec. 14, NW1/4 Sec. 13, SW1/4 Sec. 12 & SE1/4 Sec. 11
46	Easement Agreement	U. S. West Communications, Inc.	City of Bismarck	8/17/1999	Doc. No. 531711	10' easement for electrical facilities over the SE1/4 Sec. 14 and the NE1/4 Sec. 23
47	Easement	University of Mary	City of Bismarck	5/17/2002	Doc. No. 573617	Multiple width easements for utilities over Sec. 23
48	Easement	ND Department of Transportation	City of Bismarck	11/20/2002	Doc. No. 583717	Easement for public highway over part of the SW1/4 of Sec. 10
49	Easement Agreement	Montana-Dakota Utilities Company	City of Bismarck	4/3/2003	Doc. No. 592881	Easement agreement for two 10' strips for natural gas facilities over part of the NE1/4 of the SE1/4 Sec. 10
50	Easement Agreement	Montana-Dakota Utilities Company	City of Bismarck	4/3/2003	Doc. No. 592882	15' wide easement for utiliies located in part of Sec. 11, 12, 13 & 14
51	Right-of-Way Plat	Public	North Dakota Department of Transportation	6/6/2003	Doc. No. 598050	Right-of-Way plat for highway pruposed over part of the SE1/4 Sec. 22 and the SW1/4 Sec. 23
52	Easement Agreement	City of Linclon	City of Bismarck	8/31/2004	Doc. No. 624733	20' and 40' easement for watermain in part of Lots 1,3, &4 of Lincoln Outlots
53	Affidavit of Section Line Closure	Public	Burleigh County	8/8/2005	Doc. No. 641482	Affidavit of Section Line Closure to vacate the public ways between part of Sec. 15 & 22, Sec. 22 & 23, and Sec. 14 & 15
54	Easement Agreement	Montana Dakota Utilities	City of Bismarck	5/27/2006	Doc. No. 657061	10' easement agreement for fiber cable facilities through parts of Sec. 23, Sec. 14 & Sec. 15
55	Easement	City of Bismarck	City of Bismarck	3/1/2011	Doc. No. 741493	42' easement for street and highway over part of Lot 1, Block 17 of Bismarck Airport Addition
56	Easement	City of Bismarck	City of Bismarck	3/1/2011	Doc. No. 741492	42' easement for street and highway over part of Lot 1, Block 16 of Bismarck Airport Addition
57	Easement Agreement	Montana Dakota Utilities Co.	City of Bismarck	1/21/2011	Doc. No. 739746	10' wide easement for fiber cable facilities over part of the NE1/4 Sec. 23
58	Plat	Public	City of Bismarck/ ND Association of Soil Conservation Districts	3/1/2011	Doc. No. 741481	Plat of Bismarck Airport Addition
59	Easement Agreement	Capital Elecrtric Cooperative	City of Bismarck	8/3/2011	Doc. No. 748532	40' and 15' easement for ungerground electric facilities over Lots 2 & 3 of Block 17 of Bismarck Airport Addition
60	Easement	Northern Metals, LLC	City of Bismarck	6/13/2013	Doc. No. 789127	80' easement for access over part of Lot 1, Block 1 Northern Plains Commerce Centre Addition & part of Lot 2, Block 1 of Bismarck Airport Addition
61	Easement	Capital Electric Cooperative	City of Bismarck	12/4/2013	Doc. No. 799114	20' easement for transmission line over part of the SW1/4 Sec. 23
62	Easement Agreement	Montana Dakota Utilities	City of Bismarck	3/10/2014	Doc. No. 803059	15' wide easement for electrical line located in part of Sec. 11, 12, 13 & 14 (same easement location as encumbrance 50)
63	Easement Agreement	Paramount Builders, Inc.	City of Bismarck	6/2/2014	Doc. No. 806759	20' wide easement for storm sewer located in part of Lot 2, Block 7, Bismarck Airport Addition
64	Easement Agreement	Montana Dakota Utilities & Quest Corporation	City of Bismarck	8/2/2018	Doc. No. 875431	Easement for utility lines located in part of Lots 1 & 62 of Block 1 of Bismarck Airport Addition
65	Easement Agreement	Montana Dakota Utilities & Quest Corporation	City of Bismarck	8/2/2018	Doc. No. 875432	Easement for utility lines located in part of Lot 1, 60, 61 & 62, of Block 1 of Bismarck Airport Addition.
66	Easement Agreement	State of North Dakota	City of Bismarck	2/20/2018	Doc. No. 868655	Release and reassignes a 50' easement for storm sewer purposed in part of Lot 1, Block 1 of Bismarck Airport Addition

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CITY OF BISMARCK
BISMARCK AIRPORT LAYOUT PLAN

2301 UNIVERSITY DR., BISMARCK, ND 58504

ISSUED

NOT FOR CONSTRUCTION

M&H PROJECT: 2716000-140293.01
AIP NO.: 3-38-003-055-2015
DATE: JAN 2019
DESIGNED BY: M&H
DRAWN BY: JWB
CHECKED BY: MRB
DO NOT SCALE DRAWINGS

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AIRPORT PROPERTY MAP - EXHIBIT 'A' EASEMENT TABLE

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MASTER PLAN UPDATE

Bismarck AIRPORT

APPENDIX F

Bismarck Airport Master Plan Public Involvement Program

APPENDIX F

1. Introduction

The purpose of a public involvement plan is to document the time and effort spent to include the thoughts and ideas of interested parties both internal and external to the Bismarck Airport Master Plan Update. The Airport and the Federal Aviation Administration (FAA), who are financing this master plan update, place great importance on being able to connect with the public, BIS's tenants, businesses and municipal partners, and to listen and document their views as critical to the BIS Master Plan Update. The Bismarck Airport together with the master plan consultants have developed a public involvement plan and processes to gather feedback from constituents for use in the process.

2. Public Involvement

The public has been invited into the planning process in a variety of ways. A Study Work Group (SWG) has been chosen to guide the process along with airport and interested party focus groups to gather valuable information for planning. Three separate public input meetings and a dedicated master plan website (see Figure 4 and 5) have been initiated so interested parties can post questions and comments and receive feedback pertaining to the master plan. The dedicated page can be found on BIS's main webpage www.bismarckairport.com.

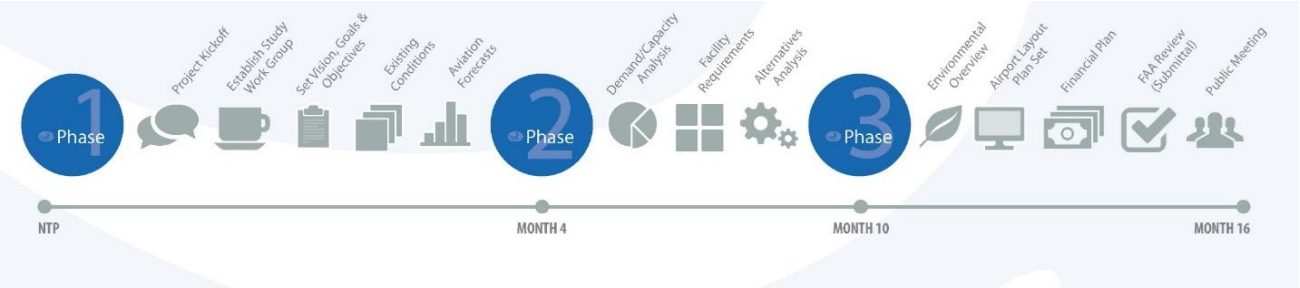
2.1 What is a Master Plan?

The airport master plan is a comprehensive study of the airport that catalogs and discusses many issues for BIS related to growth and development. The plan develops the short-, medium- and long-term infrastructure alternatives by synchronizing BIS's growth with the community's growth (see Figure 1 for the flow of the process). A master plan is considered a "roadmap" for future airport development. The key elements to consider are:

- The airfield—runways, taxiways, and aprons
- The landside—roadways, parking lots, and ground transportation needs
- Land use—the airspace and safety areas and land surrounding the Airport

- The terminal—gate space, security, airline needs, and concessions
- Environmental considerations—ground water and storm water runoff
- Other future issues that may impact the Airport's growth strategy.

Figure 1. Master Plan Process and Flow Chart



2.1.1 Public Involvement Opportunities

The Bismarck Airport together with the master plan consultants outlined several ways the public, tenants, and interested parties could be involved in the process. First, the Airport and the consultants named an SWG to steer the planning process. In addition, ten focus groups assembled to discuss the airport, and three public input meetings were advertised and held in the airport terminal lobby. As referenced, the Airport also posted a master plan link on their website, where anyone can read the planning materials and documents, and submit a comment.

2.1.2 Study Work Group (SWG)

The consultant and airport administration determined the Master Plan study would be guided by an SWG. The SWG consisted of airport tenants, federal, state, city and county representatives, and business groups from the city of Bismarck/Mandan and Burleigh County. The SWG held a kick off meeting on Tuesday December 1, 2015, with five subsequent meetings throughout the course of the master plan work period. **Table 1** lists the SWG roster.

Table 1. Original Study Work Group (SWG) Membership Roster

Group Member	Representing:
Steve Colberg	Basin Electric Corporate Flight Department
Paul Helten	ND Army National Guard
Doug Hilson	FAA Tower
Tom Painter	ARFF Chief
Jared Wingo	NDAC Aviation Planner
Kyle Wanner	NDAC Director
Tim Thorsen	BIS
Greg Haug	BIS
Josh Askvig	City Commissioner – Bismarck
Jon Simmers	Bismarck Aero Center
Chris Brown	Motix
Matt Reichert	Aspen Group
Kelvin Hullet	Chamber of Commerce – President
Carl Hokenstad	City of Bismarck – Community Development
Brian Ritter	Bismarck-Mandan Development Association
Steve Saunders	MPO – Bismarck
Steve Koppy	FAA Tech Ops
Mark Holzer	FAA
Scott Brownlee	FAA
Kathleen Jones	Burleigh County Commission
Paul Vetter	Executive Air Taxi
Ervin Fisher	City of Lincoln

*There were substitutions during the planning period, due to employment changes.

The second SWG meeting was held on Tuesday, March 15, 2016. The discussion

centered on the working draft of Chapter 1.0: Inventory of Existing Conditions. The conversation focused on the needs of the terminal and air service development and the changing dynamic of the airline industry business models and aircraft fleet mix.

The third SWG meeting was held on Tuesday, November 29, 2016. The discussion centered on facility planning and future forecasts of airport growth. In the near term, the items of concern were public parking at the terminal, Unmanned Aerial Systems (UAS/drones) and their impact, as well as future plans for the fixed based operators (FBOs) on the field.

The fourth meeting was held on Wednesday, July 12, 2017. It was scheduled to last the longest (four hours) to allow adequate time for the consulting team to present the design alternatives. Two alternatives were presented for each of the following areas on the Airport: Airside, Landside, Terminal, and Parking areas.

Most of conversation revolved around the landside and parking alternatives. The conversation was robust, and it was apparent that neither alternative would be accepted in totality. Instead, a hybrid concept would be developed based on input from the SWG and the public outreach meeting later that evening. It was determined that the Airside was nearly built out, aside from some possible future general aviation expansion that will be triggered upon request. The main air carrier runway is currently under a full rehabilitation, and that will be completed by 2018.

There was also discussion of the terminal that was built in 2001 and is undergoing some growing pains. The alternatives

focused on the secure/gate area of the terminal and its expansion, along with the Transportation Security Administration (TSA) checkpoint, passenger egress, vehicle parking and roadways.

The Airport has seen substantial growth in the number of vehicle and rental car parking spaces needed since the area was developed in 2001. As mentioned, the discussion will be incorporated into the final design alternatives of the Master Plan Update.

The fifth SWG meeting was held on March 21, 2018. At this meeting the consulting team reviewed the progress made to date.

The critical aircraft for the Airport was established as an MD 80 for the short-term period and would transition to the Airbus A-320 as the MD 80 reaches its useful life span sometime during the next 20 years. The forecast chapter had been approved by the FAA, and there was a short review of the preferred alternative chosen as it pertained to the airside, landside, and terminal areas.

Most of the conversation and questions revolved around the terminal expansion, vehicle parking and associated roadways. The airside is currently built out as needed, and the focus for the next 10-20 years will be the terminal and landside components.

During the final portion of the meeting, the consulting team demonstrated the Airport's Geographical Information System (AGIS) built for the master plan. The FAA requires AGIS, which is also a valuable tool that the planners of the City of Bismarck, Burleigh County, and real estate developers can use to check all future building sites for land use compliance with the Airport's airspace.

The sixth and final meeting of the SWG was held on Monday April 8, 2019, where discussion focused on the master plan in total, including the financial review and airport layout plan. During the short review of the master plan to date that started the meeting, it was noted that the critical aircraft for the runway will transition to ~~be~~ the Airbus 320 as the MD80 is withdrawn from service.

The conversation with the SWG then transitioned to parking alternatives, the impact of transportation network companies (TNCs), and the Airport's financial position.

The Airport is nearing completion of a significant runway reconstruction and with funding from FAA, the State, and City of Bismarck, the Airport's financial position is good. In the future, the Airport may use passenger facility charge (PFC) revenue to pay for the runway project, which may limit the number of future projects in the near term. Overall, the Airport is fiscally responsible, resulting in a positive cash position. This fiscal responsibility makes the Airport competitive for attracting and expanding air service.

The SWG met a total of six times during the master planning process. Specific meeting note details are shown at the end of this appendix, as Exhibit 1.

Internal and External Focus Group Meetings

The second point of public involvement was to form ten unique focus groups. Group membership came from internal and external stakeholders at BIS. The focus groups

gathered on December 15-16, 2015, and January 8, 2016 (due to a blizzard in December). Groups consisted of 10-12 members totaling approximately 120 participants. The focus groups received advance details of the purpose of master planning, and then a series of airport-specific questions were asked each focus group. Members represented the areas below.

Focus Group Membership

1) Chamber of Commerce
2) Ground Services (taxi, bus, public transit)
3) Air Cargo Providers
4) Terminal Services (airline ground handlers, rental cars, restaurant)
5) Air Carriers
6) Government Partners
7) General Aviation Partners
8) Adjacent Landowners
9) Airport Employees
10) Economic Development/City and County Planners

Questions Posed to the Focus Group Members

Internal Stakeholder Group Questions

- Long-term vision for the Airport
- Customer service levels
- Infrastructure and facility need
- Policies and procedure
- Training and professional development
- Succession planning
- Technology improvements
- Performance metrics

External Stakeholder Group Questions

- Long-term vision for the Airport
- Customer service levels
- Marketing/branding opportunities
- Airport accessibility (landside, terminal and GA)
- Business development opportunities
- Stakeholder organization's long-term plans
- Infrastructure needs

These themes emerged:

- Terminal expansion needs
- Landside expansion needs
- SRE/ARFF facility requirements
- General aviation future plans
- Website/technology considerations
- Organizational elements

The information gathered from the focus group meetings was compiled and shared with the Airport's management team. The focus group members were also individually invited to the public input meetings.

2.1.3 Public Input Meetings

The third option for public involvement was open house meetings. The first public open house was held on Wednesday, March 16, 2016, from 5-7 p.m. in the Airport Terminal lobby. The Airport management sent press releases through the public information officer at the City of Bismarck to properly advise the

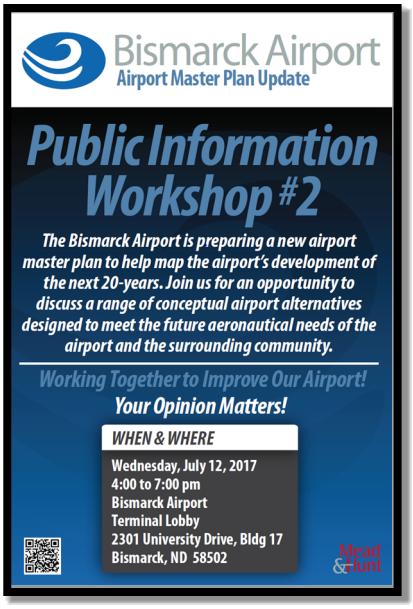
public of the meeting time, date, and location. The consultant team and the Airport manager staffed the open houses.

Attendance was low at the first public meeting, so the marketing efforts for the next open house were increased, and public information was distributed through various media outlets prior to the second public input meeting (Figure 2).

The second public open meeting was held on the evening of Wednesday, July 12, 2017, from 4-7 p.m. in the Airport Terminal lobby. This open house was held the same day as the fourth SWG meeting.

At the second public open meeting, the consulting team and Airport management discussed the design alternatives for the Airside, Landside, Terminal, and Parking. There were two alternatives developed for each of the four areas. The consulting team reached out to each individual focus group member inviting them to attend the open house, and the Airport publicized the event on their Facebook page (see Figure 2). More participants attended the second open house, and there were many good conversations to frame the continued development of the Airport Master Plan Update.

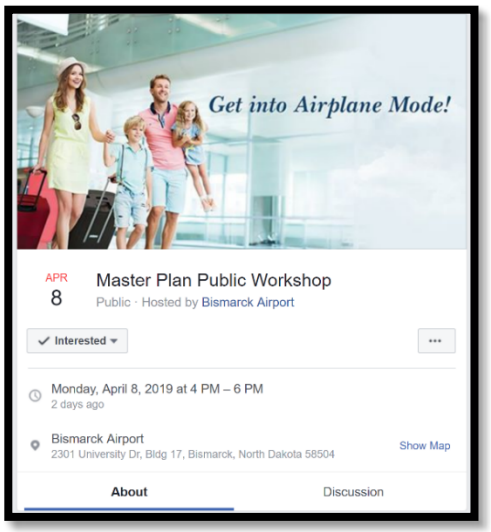
Figure 2. Mead and Hunt Invitation to Second Open House


Bismarck Airport
Airport Master Plan Update
Public Information Workshop #2
The Bismarck Airport is preparing a new airport master plan to help map the airport's development of the next 20-years. Join us for an opportunity to discuss a range of conceptual airport alternatives designed to meet the future aeronautical needs of the airport and the surrounding community.
Working Together to Improve Our Airport!
Your Opinion Matters!
WHEN & WHERE
Wednesday, July 12, 2017
4:00 to 7:00 pm
Bismarck Airport
Terminal Lobby
2301 University Drive, Bldg 17
Bismarck, ND 58502
Mead &Hunt

The third and final public input meeting was held Monday, April 8, 2019, from 4-6 p.m. At this meeting the consulting team and Airport management discussed the design alternatives that had been selected for the Airside, Landside, Terminal, and Parking. The consulting team reached out to each individual focus group member inviting them to attend the open house, and the Airport publicized the event on their Facebook page inviting the general public (see Figure 3). There were two participants at the third open house.

Figure 3. Bismarck Airport Facebook Page Advertisement Examples

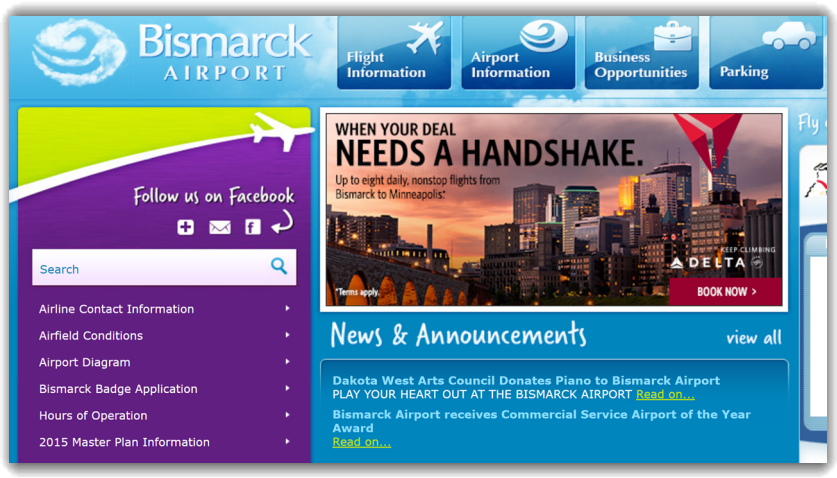
Bismarck Airport added an event.
July 3 at 1:20pm
The Bismarck Airport is preparing a new airport master plan to help map the airport's development of the next 20-years. Join us for an opportunity to discuss a range of conceptual airport alternatives designed to meet the future aeronautical needs of the airport and the surrounding community.
Bismarck
AIRPORT
JUL
12
Public Information Workshop - Bi...
Wed 4 PM · Bismarck Airport · Bismarck, ...
Jon and Matthew are going
Interested



Master Plan Update Website

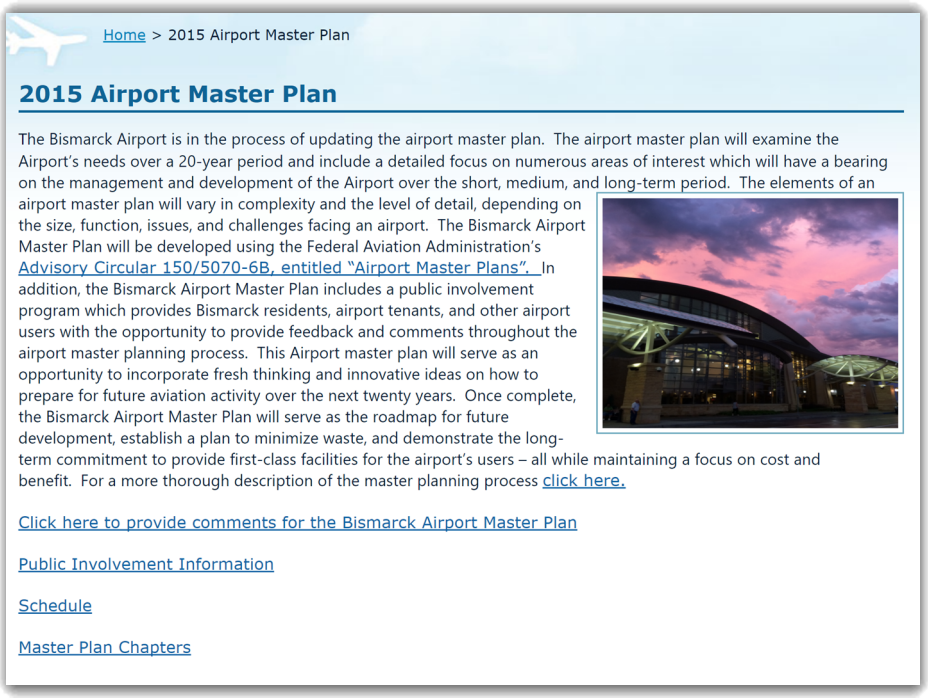
As shown below, the Bismarck Airport Website has a link that directs the reader to the master plan process, documents and schedules (see Figures 4 and 5). This provided an opportunity for anyone interested in the project to make comments that were cataloged, reviewed, and answered in a timely fashion (see Table 2 for full comments and responses).

Figure 4. Bismarck Airport Website



www.bismarckairport.com

Figure 5. Master Plan Website Public Involvement Opportunities



Home > 2015 Airport Master Plan

2015 Airport Master Plan

The Bismarck Airport is in the process of updating the airport master plan. The airport master plan will examine the Airport's needs over a 20-year period and include a detailed focus on numerous areas of interest which will have a bearing on the management and development of the Airport over the short, medium, and long-term period. The elements of an airport master plan will vary in complexity and the level of detail, depending on the size, function, issues, and challenges facing an airport. The Bismarck Airport Master Plan will be developed using the Federal Aviation Administration's Advisory Circular 150/5070-6B, entitled "Airport Master Plans". In addition, the Bismarck Airport Master Plan includes a public involvement program which provides Bismarck residents, airport tenants, and other airport users with the opportunity to provide feedback and comments throughout the airport master planning process. This Airport master plan will serve as an opportunity to incorporate fresh thinking and innovative ideas on how to prepare for future aviation activity over the next twenty years. Once complete, the Bismarck Airport Master Plan will serve as the roadmap for future development, establish a plan to minimize waste, and demonstrate the long-term commitment to provide first-class facilities for the airport's users – all while maintaining a focus on cost and benefit. For a more thorough description of the master planning process click here.

Click here to provide comments for the Bismarck Airport Master Plan

Public Involvement Information

Schedule

Master Plan Chapters

Table 2. Bismarck Airport Master Plan Comments (online)

Airline Comments	
Comment 1	*Are you planning to add another airline such like Alaska Airlines, so North Dakotans can have a chance to reach the Seattle hub?*
Airport Response	The decision to add additional airline service from Bismarck is a goal of the Airport Administration. The Airport Administration works with all interested airlines to identify future routes; however, the ultimate decision to establish new service rests with the airlines themselves. As activity at Bismarck continues to increase, so does the likelihood of additional airline service.
Customer Service Comments	
Comment 1	*Have you thought of replacing "municipal" with "regional"? Since Bismarck airport is serving to the region area. Bismarck Regional Airport, Bismarck-Mandan Regional Airport or whatever you want to call.*
Airport Response	A name change has been discussed internally in the past; however, changing the official name of the Airport requires significant coordination with the Federal Aviation Administration. A name change has not been ruled out. For the immediate future we will refer to the Airport as Bismarck Airport for

Table 2. Bismarck Airport Master Plan Comments (online)

	purposes of advertising and signage. The Airport will consider the idea in the near future.
Comment 2	*I love the terminal, it is "easy in, easy out"*
Airport Response	Thank you for your comment. The Airport Staff strive to maintain the terminal building as a safe and convenient facility with the kinds of amenities that air traveler's desire.
General Aviation Comments	
Comment 1	*Will the master plan look at corporate expansion possibilities?*
Airport Response	Yes, the airport master plan will evaluate the expansion of corporate facilities to meet the anticipated level of demand occurring within the 5-, 10- and 20-year planning periods. Key support facilities such as access roads, aircraft aprons, hangar size and location will also be considered during the development of airside alternatives to support future demand.
Comment 2	*How does the GA community at Bismarck compare to other airports of similar size? Do we have a larger or smaller GA community?*
Airport Response	It is difficult to make a one-to-one comparison of the level of general aviation activity occurring at Bismarck as opposed to similar sized airports. All airports operate differently; however, one common comparison made among airports is the type of general aviation activity they serve. The general aviation community at Bismarck Airport consists of two primary types of general aviation users, recreational and business users. Recreational users fly less frequently and do not typically require the use of advanced facilities such as an Instrument Landing System (ILS), sophisticated weather information and the presence of an Air Traffic Control Tower (ATCT). In contrast, business users (also known as corporate aviation users) do depend on the Airport's advanced facilities for purposes of conducting business. In addition, business users rely on the Airport being open during bad weather as well as the presence of rental cars, fuel, and accessibility to major transportation networks to complete their trip. See also answer to comment 3 below.
Comment 3	*What has changed in regard to general aviation?*
Airport Response	The last 10 years of general aviation activity at Bismarck Airport represents a period of fluctuation for based aircraft while general aviation aircraft operations remained fairly consistent. With respect to based aircraft, total counts have been as high as 111 (in 2005) and as low as 78 (in 2010). The principal source of this fluctuation are periodic changes in the number of single-engine aircraft, which make up the majority

Table 2. Bismarck Airport Master Plan Comments (online)

	of the based aircraft fleet. To a lesser degree, multi-engine aircraft have also contributed to the changes in based aircraft. During this same time period, the general trend for multi-engine aircraft has been of minor year-to-year variability with totals around 20 aircraft. The trend for jet aircraft has generally been one of growth over this time period. The greatest year-to-year increase in based jets occurred in the 2004-2011 period, when the number increased from four to ten. Helicopters are a small part of the fleet and have remained stable over recent years. Despite the many changes that have occurred in aviation over the last two decades, there is surprising consistency in the total number of general aviation aircraft operations occurring at Bismarck Airport. Total general aviation aircraft operations have ranged from approximately 35,000 in 2005 to nearly 40,000 in 2015. The recession of 2008-09 did see a slight decline in general aviation aircraft operations; however, 2010 begin a five-year period of growth which resulted in general aviation operations returning to previous levels.
Parking Comments	
Comment 1	*Public transit has an interest in serving this part of town. What are some different ways public transit can be used to get to/from the Airport?*
Airport Response	The Bismarck Airport Master Plan will address the options for establishing public transit to and from the Airport during the identification of facility requirements task. One of the key considerations given during the preparation of this task is access and mobility. The master plan team will coordinate with the local public transit service to determine the requirements necessary in establishing public transit service as well as estimate potential ridership. Those interested in the findings of this task should continue to check the Bismarck Airport Master Plan webpage for future working papers and attend the second airport master plan workshop anticipated in late summer 2016.
Comment 2	*Previous master plans had determined the current location of the terminal as the best alternative knowing that parking was going to be one of the first limiting factors. The Airport needs to evaluate new alternatives for parking since they are very fast.*
Airport Response	The Airport Master Plan will include future vehicular parking alternatives as part of the alternatives analysis task. Consideration for access and connectivity to the terminal building will be used as criteria for evaluating multiple landside alternatives. The selection of a preferred landside alternative will include vehicular parking improvements that meet the anticipated demand for future parking over the 20-year airport master planning period.

Table 2. Bismarck Airport Master Plan Comments (online)

Terminal Comments	
Comment 1	*We should add a new restaurant and 2-4 new gates for more boarding areas for passengers.*
Airport Response	The Airport Master Plan will address the need for additional concession opportunities during the facility requirements task. Leased concession space serves as an important source of airport revenue and will be further reviewed during the preparation of the financial plan developed near the end of the master planning process. The need for additional aircraft gates (passenger boarding bridges) will be determined based on the estimated number of passengers expected to utilize the Airport over the next 20-years. The specific type, number of gates and location will be identified during the facility requirements task of the master plan.
Comment 2	*Is Bismarck gaining passengers from DIK and Minot?*
Airport Response	As airlines reduce the number of flights from competing airports such as Dickenson and Minot, passengers will begin to utilize Bismarck Airport more. This is primarily due to fewer available seats on aircraft operating from smaller markets. It is important to mention that cost is also a contributing factor in a passenger's choice of airport. Average airfares are a result of many factors including length of haul, availability of seats, business verses leisure, and airline competition. Data assembled for use in the Bismarck Airport Master Plan indicates that on average one-way fares for passengers traveling from Bismarck was approximately $227. Bismarck's fare was approximately $24 lower than the average fare from Minot.
Comment 3	*Will funding challenges be addressed as part of the master plan? Commented that a plan is great but if we can't fund it then the plan does us no good.*
Airport Response	The Airport Master Plan will address potential funding sources for all recommended capital improvements included in the plan. The financial development plan to be included near the end of the master planning process will included a breakdown of the federal, state, and local funding shares. In addition, the financial plan will also include the anticipated level of revenue to be generated through the Airport's other funding sources such as lease revenue, landing fees, vehicular parking, and gross receipts. The overall intent of this task is to describe how each recommended project will be funded, by whom and when.
Comment 4	*What are BIS passenger boardings?*
Airport Response	A passenger enplanement is defined as the act of one passenger boarding a commercial service aircraft that departs an airport. Passenger enplanements include scheduled and non-scheduled flights of over nine passenger seats, and do not include airline crew. Passenger enplanements at Bismarck Airport have grown from 120,589 in 1998 to 259,734 in 2015. Average annual growth rates were over 4% during the oil exploration boom years (2011-2015), compared to 1.6% in the pre-oil boom years.

Note: These comments are transcribed directly from the link listed here.

http://meadhunt.maps.arcgis.com/apps/CrowdsourceReporter/index.html?appid=b2d6fa9cb2924c499d5a221683c12bff

3. Conclusion

The consulting team, along with the Bismarck Airport management worked diligently throughout the master planning process to involve the airport tenants, stakeholders, federal, state, and municipal representatives into the master planning process. The SWG was a large, intentionally diverse group of community and business members that included Airport stakeholders. A series of smaller focus group meetings were held with both internal and external stakeholders to allow for flexibility and greater conversation.

Three separate public input meetings occurred at regular intervals. These meetings also gave the community an opportunity to view and comment on the future direction of their airport. If people could not attend, or they preferred to use technology as a communication tool, the master plan website was in service for the duration of the planning process. Overall, every effort was made to incorporate the public into the Bismarck Airport Master Plan Update.

Exhibit 1: Bismarck Airport Masterplan – Study Work Group Meeting Notes

A. SWG Meeting #1 - Wednesday, December 9, 2015, 10:30 a.m.

Notes by JSB

Questions from the Group

1. Question: Kelvin Hullet – What are BIS airports passenger boardings?
   Response: Greg Haug – 250,000 – 260,000

2. Comment: Greg commented that previous master plans had determined the current location of the terminal as the best alternative knowing that parking was going to be one of the first limiting factors. The Airport needs to evaluate new alternatives for parking since they are very fast approaching max parking capacity.

3. Question: Kelvin Hullet – What has changed in regard to general aviation? Response: Jon Simmers – Two years ago he would have said that not much has changed. The same people were flying just flying more often. Now, lots of new people are flying into the area. Some are due to the energy market, but there are just more people coming in to the airport.

4. Question: Josh Askvig – Will funding challenges be addressed as part of the masterplan? Commented that a plan is great but if we can't fund it then the plan does us no good.
   Response: Bart – Yes, we will look at funding in the financial sections towards the end of the planning process.

5. Question: Matt Reichert – Is Bismarck gaining passengers from DIK and Minot? Response: Greg Haug – Yes, the airport has gained some from reduced service

in DIK and Minot. BIS also has more opportunities for getting places and continues to gain service. These additional opportunities also play a part in higher passenger boardings in addition to the reduced services at other airports. Bismarck has continued to see boardings rise over the years.

6. Question: Matt Reichert – How does the GA community at Bismarck compare to other airports of similar size? Do we have a larger or smaller GA community?

   Response: Jared Wingo – Corporate GA has a larger presence at the BIS airport. Mentioned that the airport may have seen a reduction in smaller GA aircraft due to the Mandan airport that is just across the river.

   Response: Kim – Bismarck/Mandan are really the only true sister city airports in the state. As such, BIS has to deal with competition from Mandan for the smaller GA aircraft. People flying smaller GA planes very infrequently tend to use Mandan due to less rules, less traffic, lower costs and less general hassle.

   Response: Tim – Bismarck gets the larger corporate GA planes because they have more of the services that they are looking for (fuel, rental cars, accessibility, etc.).

   Response: Bart – The master plan will look at the forecast and growth trends at the BIS airport. This is important when looking at what facilities are needed and why.

Expectations from the Group

1. Bart – Revenue generating opportunities

2. Bart – Communicating and improving customer experience

3. Matt Reichert – State of facilities/review of existing conditions.
    a. Bart responded that this would be provided prior to the next study work group meeting.

4. Matt Reichert – Asked Bart to provide a list of things that other airports have done as a jumping off point for the group to think about.

5. Josh Askvig – Expressed public transit opportunities. Public transit has an interest in serving this part of town. What are some different ways public transit can be used to get to/from the airport? His personal experience when flying is to walk to the airport due to one of the following reasons; a) he doesn't want to pay for parking, b) he doesn't want to leave his car parked at the airport, or c) doesn't want to wake his family to drive him to/from the airport. These could be similar issues for others in the community.

6. Question: Chris Brown – Will the master plan look at corporate expansion possibilities?
    a. Response: Bart – We will investigate this.

General Meeting Comments

1 – Study Work Group Meeting #2 - March 15, 10:30-12:30

2 – Public Meeting in the terminal – March 16, 2016

3 – Everyone was ok with submittals being in electronic form.

B. SWG Meeting #2 Tuesday, March 15, 2016, 10:30 a.m.

Notes by JSB

Comments from the Group – Matt Dubbe (Architect) Presentation

1. Greg commented to the group that this meeting was just to discuss an inventory of the existing conditions. Alternatives in regard to the terminal and any possible changes will be part of the next meeting.

Comments from the Group – Joseph Pickering (Air Service Development) Presentation

2. Question/Comment: Josh Askvig – Why was the average week of June used in the analysis and how does that differ throughout the year?

   Response: Joe – Future enplanements are tied to year projections.

3. Questions/Comment: Josh Askvig – Can we somehow mitigate travelers leaving Bismarck to use another airport?

   Response: Joe – We can take a look at demand by month, showing peaks and valleys, and also tie it to what is happening locally that drives the demand. This information can then be taken to carriers and accurately show them what happens and why locally. This helps them decide on what and how much air service to provide throughout the year.

4. Questions/Comment: Matt Reichert – How is forecast reflecting downturn in oil?

Response: Joe/Bart – We have taken a conservative approach. We don't want to over develop. Trigger points will be developed as part of the process that will help us decide when additional facilities are needed.

5. Questions/Comment: What has caused the downturn in capacity?

   Response: Greg – In some instances, capacity was pulled and moved to Williston and Minot to chase demand. That is why Bismarck showed a decline in one year but was back up after that.

6. Greg commented that as we move to larger aircraft, our schedule will change. The larger aircraft will restrict schedule options but allows for more cargo, hunting dogs and human remains to be moved in and out of the community.

Comments from the Group – Dave Dietz Presentation

7. Question/Comment: Josh Askvig – Do we make scenario-based forecasts based on what is happening with oil?

   Response: Dave – We will be digging into this farther. Kyle Wanner – This is what is needed as we start to go through this process. Development of the trigger points will help us be prepared. Bart – Trigger points are a key part, and these will be included as we move forward. We want to make sure we give ourselves options that can be modified to work as necessary for the conditions.

General Meeting Comments

1. Study Work Group Meeting #3 – Late August, Early September 3-hour meeting, 10:30 a.m.-1:30 p.m.
2. Public input meeting March 16, 2016; 5-7 p.m. Airport Terminal Lobby

C. SWG Meeting #3 - Tuesday, November 29, 2016, 10:00 a.m.

Notes by JSB

Comments from the Group – Catchment Area

1. Question/Comment: Jon Simmers – how was the catchment area developed?

   Response: Greg – When the airport meets with airport users each year, they use a map based on drive times from the airport.

   Response: Bart – We developed a map based on the zip codes of actual passengers. This could change slightly every time you pull the information depending on time of year or what services are available at a specific time.

Comments from the Group – Facility Requirements

2. Question/Comment: Greg/Mark – Runway 13 ILS change due to terrain.

   Response: Possible MALSR upgrade. ~~Not able to reliably fly a coupled ILS approach.~~

Comments from the Group – Parking

3. Question/Comment: Greg – to accommodate some of these parking spots, we may need to make significant existing infrastructure changes and those have some significant costs. An example would be relocating the road system into the airport and shifting it closer to the southwest. As we move forward in the Master Plan, this will be a challenge that Mead & Hunt will be looking at.

Response: Tim – commented that a parking garage could cost ~$25,000/stall versus a surface lot being $2,200/stall so the cost difference is a big deal. Also need to consider how far of a walk is acceptable.

4. Question/Comment: Jerry – Asked if we have done any customer surveys to get a feel about what their main concerns are.

   Response: Greg – We have not done customer surveys. The airport tries to monitor lines and make sure any areas that are getting backed up are fixed. They have recently made improvements to the parking system including signage, computer systems and how customers get out of the lot. TSA has also improved by adding a TSA precheck line. Airport also would like to increase the size of the mezzanine to help with passenger flow.

5. Question/Comment: Jerry – Who pays for parking garage or surface lots? Response: Greg – The airport would have to pay for parking upgrades. Response: Kyle – It is allowable per the state, but it has a very low priority, so they never get around to having enough funding.

6. Question/Comment: Mark – Can PFCs be used to help pay for the parking lot? Response: Tim – No, PFC can't be used on anything that is revenue generating.

General Meeting Comments

7. Question/Comment: Jon Simmers – Who/When can he provide his comments to and share his future plans?

Response: Bart/Matt – Jon can talk to them directly after the meeting or on a phone call.

8. Question/Comment: Jon Simmers – Does the study look at existing and future growth?
   Response: Bart – Need to have a conversation with the airport and FBOs soon.

9. Question/Comment: Kyle – Has UAS operations been mentioned and looked at as part of the master plan. Should we mention UAS in the report?
   Response: Greg – Liked the idea of adding in a couple paragraphs about UAS.
   Response: Kyle – Added that he thought it would be good to acknowledge UAS and add in any info that is currently out there.
   Response: Mark – Would UAS get its own designated area on the airfield?
   Response: Bart – UAS are tough to account for but we need to be aware if this is something that is in the future for the airport. Add a section about UAS opportunities for the airport to the report and reference where appropriate.
   Response: Jon – Mentioned that UAS operations mostly differ from other operators in their ground operation. Add a paragraph about this in the report.

10. Question/Comment: Jon Simmers – He currently has a list of people looking for hangar space but it's not as long as it used to be.

11. Study Work Group Meeting #4 – April sometime, a little longer meeting due to amount of material to cover.

12. Public Meeting #2 in the terminal – Same day as study work group meeting #4 in April.

D. SWG Meeting #4 – Wednesday July 13, 2017 – 9:00 a.m. – 1:00 p.m.

Notes by JSB

Comments from the Group – Forecast

1. Question/Comment: Greg – The airport has noticed a reduction in the number of twin-engine piston aircraft on the airfield. They have also seen a reduction in the number of single-engine airplanes in the past but that has leveled off lately. Turbo props and jets seem to be trending up. Is this typical to what is happening across the country?
   Response: Bart – Yes, this is the class of aircraft that seems to be suffering and is a typical trend across the country.
2. Question/Comment: Josh Askvig – Noted that the reduction in operations may help the airport as far as pavements but that the increase in enplanements will result in more people being in and using the facilities which will have a huge impact on the terminal and parking areas.

Comments from the Group – Airside Alternate 1

3. Question/Comment: Greg – Maintenance would like to see the two grass areas North of the restripe on the GA apron, paved to allow for easier snow removal. If we pave these areas and stripe them to make sure that aircraft to use that portion of pavement, would we be in compliance?
   Response: Bart – Yes, this would be something to help the airport operate and would be in compliance. It's an advantage for the airport to deal with the snow and could be justified.
4. Question/Comment: Mark – Were the crosswind runway RSA grades checked for compliance?

Response: Bart – Thought the RSA was in compliance, but we will double check them. The ALP would also dive into this issue a little further.

Comments from the Group – Airside Alternate 2

5. Question/Comment: Tim – We are building TW C1, C3, and C5 one category larger than the others to handle the occasional larger aircraft that do actually come to the airport.
6. Question/Comment: Greg – The current project is a Runway project, so the runway is being redone and the taxiways are being redone to the hold bar + 50 feet. The remaining portions of the taxiways will be redone when the airport completes the taxiway project.

Comments from the Group – Landside Alternate 1

SRE

7. Question/Comment: Greg – Having a drive through building with larger garage doors on both sides would help the staff and allow for the larger, wider equipment. The short-term proposal wouldn't be as efficient. The building would be getting quite long, and the layout would not be very efficient. Currently maintenance has to shift equipment between buildings based on the season for snow removal operations and mowing operations. It is just not efficient.
8. Question/Comment: Tim – There is a mandatory limit for how much time they have to clear certain areas of pavement during the winter. As the airfield activity increases, more machinery would be required to meet this limit. This will require more space for the new equipment the airport would have to purchase.

HANGARS

9. Question/Comment: Greg – With the lower number of small aircraft, is our shown plan for development too aggressive? Also noted that just because a T-Hangar is shown on the plan doesn't mean that they can't build some other kind of hangar in that location.
   Response: Bart – A staged approach may be the best plan for hangar. development. Our preferred Alternative will most likely be a staged approach to our options.
   Response: Tim – It is ok to show all the hangar development since these are only built by a trigger point and allows the airport to make decisions at that time.
   Response: Mark – It is always good to show more in the master plan, so the airport has options when the plan to develop is triggered.

FBOs

10. Question/Comment: Mark – Can you talk about FBO development?
    Response: Bart – The most natural place for FBO development to occur is in the same area as the current FBO operations. Ultimately the FBO decides what they want and makes the request to the airport.
    Response: Greg – The FBO brings the plan of what they want to the airport and the airport makes decisions. The airport does try to minimize the space between buildings since the space along the ramp is prime real estate and they want to make sure they protect it for future development.
    Response: Tim – FBOs want to keep their operations close to their existing buildings otherwise it's just not economical. The proposed locations shown in the alternatives is what the FBO wants. They don't want them anywhere else.

Service Roads

11. Question/Comment: Mark – Can you show an access road on how to get to the area "reserved for future aeronautical development" shown in the blue box? Access from Trade Street.
12. Question/Comment: – Add a south service road.

Comments from the Group – Landside Alternate 2

13. Question/Comment: Kyle Wanner – How old is the SRE building? At some point it might be beyond its useful life so maybe moving it would be a logical choice versus adding on to it.
14. Question/Comment: Josh Askvig – Will the terminal alternatives drive the landside alternative options?
    Response: Bart – It could be a mix of both, but one doesn't necessarily drive the other.
15. Question/Comment: Mark – Where is the critical area and is our development clear of it?
    Response: Bart – Any development would have to be run through airspace before development occurs.
    Response: Greg – The airports radar is a 17-foot tower with 3-degree angle and 1500-foot circle.

Comments from the Group – Parking Alternate 1

16. Question/Comment: Josh Askvig – Lyft and Uber are in town and public access is improving around town. Are these services factored into calculations when determining number of parking spaces needed?
    Response: Bart – It is tough to factor in. Calculations take into account the out of town people traveling to the airport, the market, and cost of parking. Parking is a significant part of revenue at airports and needs to be planned for accordingly.
    Response: Tim/ Greg – Noted that state law does not allow the airport to charge a fee for Uber and Lyft. Something the state might want to look at changing.

17. Question/Comment: Kyle Wanner – How is the current toll going to be utilized to access the 150 spots next to existing parking? How will the lot be divided for short and long term? May want to consider moving the current toll access for the short and long term lots to a different area. May provide additional spots by moving it versus keeping the current location.

Comments from the Group – Parking Alternate 2

18. Question/Comment: Josh Askvig – Have we explored partnerships for off airport parking service with a shuttle? Have we looked at a walkway/enclosure from the economy lot to the terminal building?
    Response: Greg – The airport has not looked at partnerships in depth. They have looked into moving the rental car storage off site. The enclosed walkway has been talked about a little but haven't explored it in detail.
19. Question/Comment: Kim – Has the airport received any requests from parking companies like ABC, etc.
    Response: Tim – No, the airport hasn't had these requests.
    Response: Jon – Another trend in corporate policies is shifting from parking at the airport to requiring employees to take an Uber/Lyft/Taxi.
20. Question/Comment: Bart – Has the airport noticed an increase in Uber/Lyft service at the airport?
    Response: Greg – Yes, but it is a quick service. Similar to having a family member pick up curbside.
    Response: Kim – The airport could provide a staging lot for Uber/Lyft and eventually charge them to stage. Portland does this.

Comments from the Group – Terminal Alternate 1

21. Question/Comment: Greg – Need to figure out what airlines need? Seeing more self-service kiosks in and they are requiring less space. This is part of the reason that a larger expansion in the ticketing area is not being shown.
22. Question/Comment: Josh Askvig – How often do aircraft need to shift to different gates?

    Response: Greg – Occasionally an aircraft will have to shift to another gate. With this option, the deice operation causes the most concern. Aircraft push back to deice and then block enough of the ramp that others can't get by them. Response: Kim – Noted that this Alternative would most likely not have a favorable outcome if a Risk Management Panel were to take a look at it.

Comments from the Group – Terminal Alternate 2

23. Question/Comment: Kathleen Jones – Currently it gets very congested in the exit lane area. When we expand the TSA area this could get worse.

    Response: Jon – Exit lanes and inbound lanes could be separated at some point to help with the flow of people.
24. Question/Comment: Josh Askvig – The center bump by TSA needs to go out further. If the gates in the center were being used there is not enough room for passengers who are boarding, passengers in the composure area and the flow of passengers to work correctly.

    Response: Greg – Agrees this bump would need to be larger.
25. Question/Comment: Josh Askvig – Which side/direction of the proposed terminal would get built first?

    Response: Greg – Perhaps terminal expansion should be shown in phases, so it is clear which direction gets built first.
26. Question/Comment: Tom Painter – Make sure there is enough room between jetways to allow ARFF to get close enough to the building to be able to fight fires efficiently.

27. Question/Comment: Kim – Could maintenance move somewhere close to the ARFF facility? This would help recover some landside area back for additional parking expansion or other landside development. If they were airside it might help to improve response time for snow removal.

Comments from Public Meeting

28. Question/Comment: Kim – Representative from Basin noted that there is a future building shown where their parking lot currently is.

E. SWG Meeting #5 – Wednesday March 21, 2018 10:00 am – 1:00 pm

Notes by JSB

Comments from the Group – Forecast

1. Question/Comment: Tim – The airport had 272,000 enplanements in 2017 which helps further prove our forecast.

Comments from the Group – Parking

2. Question/Comment: Clark Johnson – How long does it take to get to the terminal from the economy lot that is farthest from the airport? What is the industry standard for walk length that is recommended and tolerated by customers?
   Response: Bart – The industry standard is about 750 feet. The lot here is about 1,000 feet which is a little farther than the standard but could still be appealing to the cost-conscious people.
   Response: Tim – The customers view this as a better deal and can justify the longer walk time. Plus, a surface lot is cheaper for both the customer and for construction.

F. SWG Meeting #6 – Monday April 8, 2019 10:00 am – 1:00 p m

Submitted by Kim Kenville

Meeting began at 10:00 a.m. in the Airport Conference Room, Bismarck Airport Terminal The meeting had 13 SWG members in attendance along with the consultants of Mead and Hunt, Kim Kenville Consulting and Leibowitz and Horton. The FAA representatives were not in attendance.

Bart Gover, M & H took the committee through the work to date and focused on the alternatives for airside, landside, terminal and parking for the future. Monica Weddle from L & H led the group through a discussion of the financials for the airport and Matt Blankenship finished the presentation with a discussion of the Airport's proposed airport layout plan.

Discussion points:

Landside

Discussion of the impending impacts of Transportation Network Companies (TNCs) to the parking and roadway system at the airport. ND Legislature does not allow airports or other public entities to charge the TNCs access fees, so for the foreseeable future the amount of TNCs that utilize the airport is difficult to track. The airport is in communication with other commercial service airports across the state to track the TNC overall impact to the landside.

Parking & Roadways

The personal vehicle parking issues at BIS are imminent and expansion is in the near term. The airport will develop economy parking, and the goal is no further than a 1000-foot walk to the terminal. Pricing strategies will accompany the expansion.

Geothermal wells exist for the terminal, and closer study to determine if short-term, close-in parking can be added in that area will be explored.

Airside

The airline representative said he has been in discussion with Delta and they are looking at more and larger aircraft into BIS and are looking at increasing the amount of de-icing equipment (6500-gallon truck) and supplies to the airport for the next snow season. The airport is prepared with a designated area on the ALP.

The airport and airline are discussing the number of aircraft that remain overnight (RON) and how to accommodate future needs.

Financial

The airport is in a good financial position, the runway project was funded by FAA, State and City. The portion of the city funding will be paid back via passenger facility charges (PFC) which will stretch out for the next 10-15 years.

A discussion of the recent passage of Prairie Dog may contribute to funding future airport capital improvement plans

The airport could raise fees, but it is an overall good place in terms of revenue and expenses per passenger. Lower fee structure is used as promotional technique to market to air carriers for new or enhanced service, which has been successful to date.

The final public open house will be from 4-6 p.m. today (4/8/2019) in the terminal lobby. The meeting concluded at 1:00 p.m.

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Burleigh County, North Dakota

Not for consultation

Local office

North Dakota Ecological Services Field Office

(701) 250-4481
(701) 355-8513

3425 Miriam Avenue
Bismarck, ND 58501-7926

http://www.fws.gov/northdakotafieldoffice/endspecies/endangered_species.htm

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.

5. Click REQUEST SPECIES LIST.

Listed species[1] are managed by the Endangered Species Program of the U.S. Fish and Wildlife Service.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
Least Tern Sterna antillarum No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8505	Endangered
Piping Plover Charadrius melodus There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot Calidris canutus rufa No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane Grus americana There is a **final** critical habitat designated for this species. Your location is outside the designated critical habitat. https://ecos.fws.gov/ecp/species/758	Endangered

Not for consultation

Fishes

NAME	STATUS
Pallid Sturgeon Scaphirhynchus albus No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7162	Endangered

Mammals

NAME	STATUS
Gray Wolf Canis lupus No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/4488	Endangered
Northern Long-eared Bat Myotis septentrionalis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The migratory birds species listed below are species of particular conservation concern (e.g. Birds of Conservation Concern) that may be potentially affected by activities in this location. It is not a list of every bird species you may find in this location, nor a guarantee that all of the bird species on this list will be found on or near this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the AKN Histogram Tools and Other Bird Data Resources. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Not for consultation

NAME	SEASON(S)
American Bittern Botaurus lentiginosus https://ecos.fws.gov/ecp/species/6582	Breeding
Baird's Sparrow Ammodramus bairdii https://ecos.fws.gov/ecp/species/5113	Breeding
Bald Eagle Haliaeetus leucocephalus https://ecos.fws.gov/ecp/species/1626	Wintering
Bell's Vireo Vireo bellii https://ecos.fws.gov/ecp/species/9507	Breeding
Black Tern Chlidonias niger https://ecos.fws.gov/ecp/species/3093	Breeding
Black-billed Cuckoo Coccyzus erythropthalmus https://ecos.fws.gov/ecp/species/9399	Breeding
Common Tern Sterna hirundo https://ecos.fws.gov/ecp/species/4963	Breeding
Dickcissel Spiza americana	Breeding
Ferruginous Hawk Buteo regalis https://ecos.fws.gov/ecp/species/6038	Breeding
Golden Eagle Aquila chrysaetos https://ecos.fws.gov/ecp/species/1680	Wintering
Grasshopper Sparrow Ammodramus savannarum https://ecos.fws.gov/ecp/species/8879	Breeding
Hudsonian Godwit Limosa haemastica	Migrating
Loggerhead Shrike Lanius ludovicianus https://ecos.fws.gov/ecp/species/8833	Breeding
Marbled Godwit Limosa fedoa https://ecos.fws.gov/ecp/species/9481	Breeding
Nelson's Sparrow Ammodramus nelsoni	Breeding
Red-headed Woodpecker Melanerpes erythrocephalus	Breeding

Short-eared Owl Asio flammeus https://ecos.fws.gov/ecp/species/9295	Year-round
Sprague's Pipit Anthus spragueii https://ecos.fws.gov/ecp/species/8964	Breeding
Swainson's Hawk Buteo swainsoni https://ecos.fws.gov/ecp/species/1098	Breeding
Upland Sandpiper Bartramia longicauda https://ecos.fws.gov/ecp/species/9294	Breeding
Western Grebe aechmophorus occidentalis https://ecos.fws.gov/ecp/species/6743	Breeding
Willow Flycatcher Empidonax traillii https://ecos.fws.gov/ecp/species/3482	Breeding
Yellow Rail Coturnicops noveboracensis https://ecos.fws.gov/ecp/species/9476	Breeding

Not for consultation

What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?

Landbirds:

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

Atlantic Seabirds:

Ranges in IPaC for birds off the Atlantic coast are derived from species distribution models developed by the National Oceanic and Atmospheric Association (NOAA) National Centers for Coastal Ocean Science (NCCOS) using the best available seabird survey data for the offshore Atlantic Coastal region to date. NOAANCCOS assisted USFWS in developing seasonal species ranges from their models for specific use in IPaC. Some of these birds are not BCC species but were of interest for inclusion because they may occur in high abundance off the coast at different times throughout the year, which potentially makes them more susceptible to certain types of development and activities taking place in that area. For more refined details about the abundance and richness of bird species within your project area off the Atlantic Coast, see the Northeast Ocean Data Portal. The Portal also offers data and information about other types of taxa that may be helpful in your project review.

About the NOAANCCOS models: the models were developed as part of the NOAANCCOS project: Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf. The models resulting from this project are being used in a number of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the Northeast Ocean Data Portal, which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?

Landbirds:

The Avian Knowledge Network (AKN) provides a tool currently called the "Histogram Tool", which draws from the data within the AKN (latest,survey, point count, citizen science datasets) to create a view of relative abundance of species within a particular location over the course of the year. The results of the tool depict the frequency of detection of a species in survey events, averaged between multiple datasets within AKN in a particular week of the year. You may access the histogram tools through the Migratory Bird Programs AKN Histogram Tools webpage.

The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North, Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

Atlantic Seabirds:

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAANCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Facilities

Wildlife refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGES AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND
- PEMAd
- PEMA
- PEMC
- PEMCd

FRESHWATER POND
- PABFx

Not for consultation

A full description for each wetland code can be found at the National Wetlands Inventory website: https://ecos.fws.gov/ipac/wetlands/decoder

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.